The British Bee-Keeper's Guide Book

T. W. COWAN.

296 (9)

BRITISH

Bee-keeper's Guide Book

TO THE

Management of Bees in Movable-comb Hives,

AND THE USE OF MODERN BEE-APPLIANCES.

ILLUSTRATED.

BY

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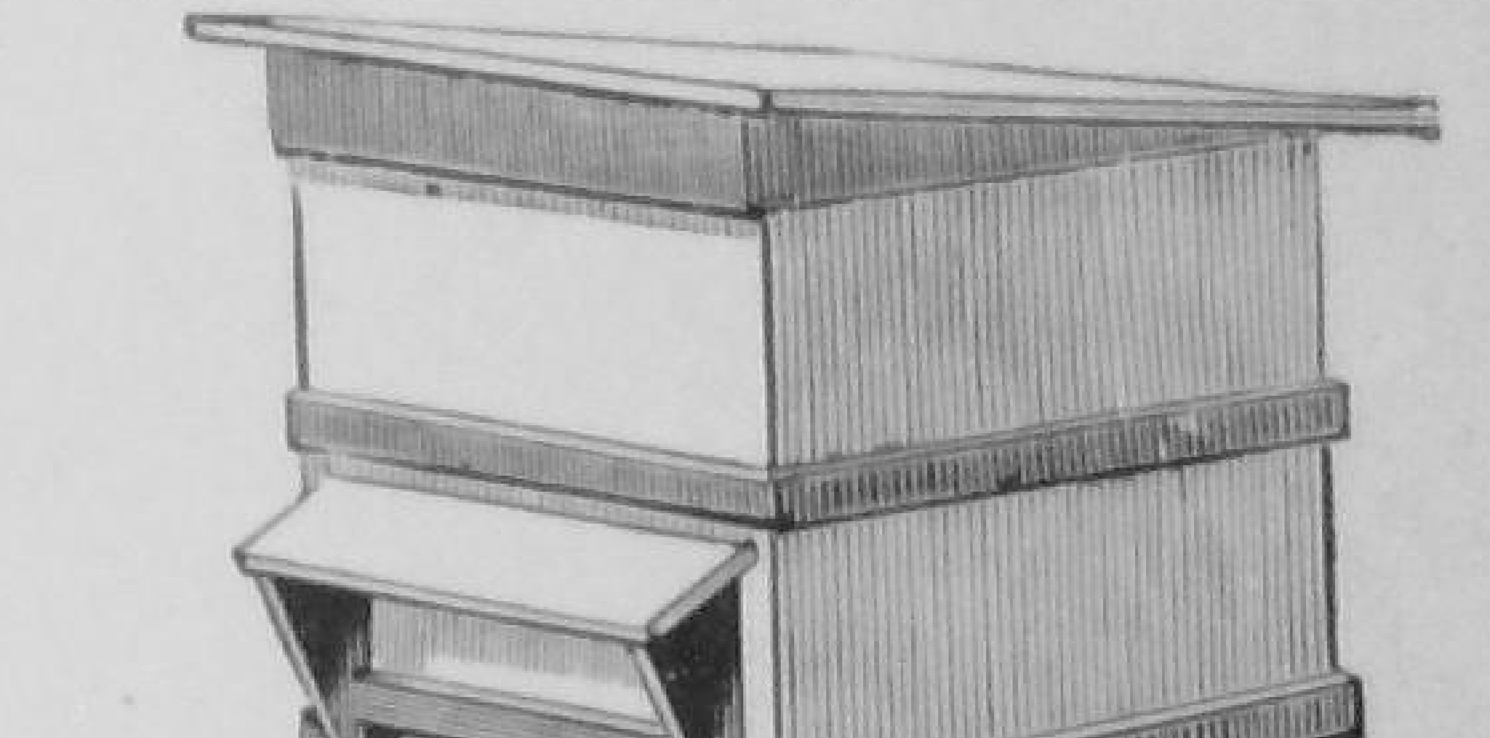

The "Cowan" Hive.

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and

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PREFACE TO THE FIRST EDITION.

SINCE the British Bee-keepers' Association was established in 1874, Bee-keeping has made such rapid progress, and notwithstanding that our Bee Literature is already represented by numerous books and the *British Bee Journal*—a periodical exclusively devoted to Bee-culture—the constant inquiries I receive respecting the practical management of bees in movable-comb hives is ample evidence that British Bee-keepers demand a treatise on Bee-culture which, divested of all verbiage and superfluities, shall plainly point out the way to success. I am frequently asked to recommend a cheap practical work on the management of frame-hives. Some excellent books on the subject that are offered for sale contain a large amount of superfluous matter, which only aids to produce a volume of respectable size, increasing its selling price, and not the practical value, placing it in many cases beyond the reach of those who would be purchasers. There are others whose value is often in inverse proportion to their bulk and cost. Some are merely advertisements of special goods for sale; whilst most are, as the Americans say, not "up witn the times," and do not even allude to matters of management, now considered indispensable by practical Bee-keepers. In endeavouring to supply this want, my object has been to produce a work which would contain the most valuable information on frame-hive management; and, to bring it within the reach of all, it has been condensed to the smallest possible scope consistent with a full exposition of the subject, with plain directions for the various most profitable operations for securing the best harvest of honey. Much disappointment is often caused by rash assertions of interested persons respecting the pecuniary profits which may be made by keeping Bees, so that I do not intend to commit myself to any direct statement upon this point. "How to make a golden fortune" is always an attractive title, and one that has sold many a pamphlet upon eggs, pigs, poultry, bees, and such-like subjects. I do not intend to enter the lists with these, but shall be contented if those who read this book, who are in a position to do so, are induced by its perusal to take a deeper interest in the wonderful works of Nature, or to adopt a pursuit which, as it must be followed in the open air, is likely to improve their health and increase their strength, while it may afford them an opportunity, not altogether to be despised, of adding a little to their income.

As the contents of this volume have been compiled from notes and practical experience, names of persons who may be connected with processes and different appliances alluded to are often omitted, not from intention, but from the difficulty of

tracing the ideas back to their originators. As it is a work of a practical character, and not a history of the science, I trust that such omissions will not affect its value.

All the practical points embodied in this work have been thoroughly tested; and if the simple directions given be faithfully carried out, Bee-keeping may be made a pursuit not only interesting, but highly remunerative.

Not having any pecuniary interest in the sale of any Bee-keeping appliances, I do not hesitate to give such description of those I use as will enable anyone to get them made for themselves.

Comptons Lea, Horsham, THOS. WM. COWAN.
November, 1881.

PREFACE TO THE NINETEENTH EDITION.

DURING the intervening years since the first issue of this work, the improvements introduced in methods of managing bees, together with constant endeavours made to keep pace with the rapid progress characteristic of the present day, have necessitated changes from time to time, and various alterations were made as years went by.

The work has met with great favour abroad, as evidenced by its translation into more foreign languages than any bee-book ever published. Among these are French, German, Danish, Swedish, Spanish, Russian, and Dutch, in some of which two and three editions have been issued. In this way the *Guide Book* seems to increase in favour with its years. The fourteenth and fifteenth editions were fully revised and improved by the addition of beautiful half-tone engravings, from photographs kindly supplied by Messrs. Newton and Co., which were taken by Mr. T. E. Freshwater, showing Mr. W. Broughton Carr among his bees in his orchard apiary on page 160. My expectations that they would add to the interest of the book have been more than fulfilled, several beginners in bee-keeping having gratefully acknowledged their indebtedness to these illustrations in making more clear than words possibly could the various items of bee-management, and the way in which live bees can be handled by an experienced bee-master. So many of the illustrations, as also descriptions, have been copied from the *Guide Book* by some writers, who have abstained from mentioning the source from which they have been derived, that I have considered it necessary to re-write a large portion of the work and have new illustrations made.

For the present edition a set of new tone-blocks have been engraved from the original photos, and a large number of high-

class engravings have been reproduced from special photographs illustrative of the educational work now being done by the British Bee-keepers' Association at their Experimental Apiary attached to the Horticultural College, Swanley, Kent. I am indebted to Mr. W. Herrod, Expert of the B.B.K.A., for a number of excellent photographs taken by himself at his apiary at Luton, together with several illustrating bee-operations and incidents connected with examinations for the third-class certificate of the B.B.K.A., photographed at the same place. To Mr. L. Upcott Gill, who generously gave me a free hand to use illustrations from Mr. Cheshire's well-known work on bees, I am indebted for Figs. 43, 44, 76, 84, 98, 108, 119, 131, 132; also to Dr. Sterry for photo of queen and worker-bees on a frame of comb, and to Mr. F. W. L. Sladen for Figs. 89, 91, 93, 94, 96, 97, and 104, illustrating modern methods of queen-rearing.

Among others to whom I am also much indebted, I may mention Dr. Burri, for permission to reproduce the series of beautiful photo-micrographs (pages 170 to 190), which have enabled me to illustrate the most recent investigations, while nine pages have been added to this chapter, treating of diseases more fully than in any previous work on bees. To Mr. Theodor Weippl I am indebted for the fine photo (from Nature) of foul brood (opposite page 173); also to Mr. Carr for valuable assistance in bringing out this work.

With the generous help thus afforded on all sides, I have felt justified in adding considerably to the size of the book by thoroughly revising the original text—where required—in the light of recent discoveries. In doing this several new chapters have been added, and the work has been brought up-to-date on all points. The present edition contains a considerable number of pages beyond any previous one, nor is any book of its kind I know of more fully illustrated.

In conclusion, I may say every illustration in the work will justify its appearance therein as being instructive, useful, and interesting. I have carefully avoided anything in the shape of "padding," and may with confidence claim for the present edition of the *Guide Book* a first place among handbooks on bee-keeping, as being the largest in point of circulation of any similar work ever published. Never before has a single edition exceeded 5,000; this is to consist of 19,000 copies, and I hope its reception will justify the increase. No expense has been spared in the endeavour to make the book equally helpful to the beginner and to the most experienced bee-keeper who is desirous of knowing all about bees and their management.

THOS. WM. COWAN.

Upcott House, Taunton,
July, 1907.

Group of Students at the Horticultural College, Swanley, Kent.

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BRITISH
BEE-KEEPER'S GUIDE BOOK.

I.—INTRODUCTION.

Apiculture—a term generally understood to include the practice and science of bee-keeping on modern methods—is admittedly one of the most profitable of rural occupations. It has engaged the attention of intelligent persons in all ages; but not till comparatively recent years has the pursuit been rendered not an entire matter of chance, as formerly, but of certainty, if the weather be not altogether adverse to the labour of the bees and the secretion of nectar.

Many of the advantages possessed by the bee-keeper of to-day are, no doubt, fairly attributable to the continued improvement of bee appliances and methods of manufacture during the last ten years; but not a little of the progress is due to the spread of apicultural knowledge by the literature devoted to the subject; nor must we lose sight of the prominence given to bee-keeping and honey production by the continual reference to the pursuit in the daily Press. This latter fact, however, has led to not a few failures, owing to persons engaging in the pursuit without possessing any knowledge of bees or their management, and, after keeping them in a more or less slovenly fashion for a few years, they have given them up in disgust through failure arising from want of knowledge of the first principles of bee-culture.

Although anyone may possess bees, it is not everyone who can become a proficient bee-master. Only

energy and perseverance, together with aptness for investigation, can ensure real success. While some degree of aptitude is essential in this, as in every other pursuit, ordinary ability—directed to the attainment of a specific end—will be more likely to be rewarded by success. The man thoroughly conversant with his business, familiar with all its requirements, master of its every detail, and who, moreover, is industrious and energetic, will succeed; and if, in addition to this, he possesses good business abilities in purchasing and marketing his goods, his success will be certain. Such a person could easily acquire all the knowledge needed for making a substantial success of bee-keeping. In other words, one man can always sell more good honey than he can secure, while another can obtain it in great quantities, yet fails to find a market for his produce. It therefore behoves everyone who engages in the pursuit to bear in mind the importance of the above-mentioned points.

Technical instruction in bee-keeping is now well within the reach of all, from the village labourer upwards, owing to the help given from the public funds by County Councils. In many counties where bee-keeping may be carried on with advantage qualified lecturers are appointed, and instruction is now brought to the very doors, as it were, of the humblest cottager or dweller in rural districts by means of free lectures and practical demonstrations in the art of bee-keeping.

There is no doubt that this progress is primarily due to the educational work of the British Bee-keepers' Association—an entirely philanthropic body—whose efforts are devoted to the furtherance of the pursuit as a rural industry, advantageous to small farmers, cottagers, artisans, and others. In this the greatest care is taken that technical instruction in its

Experimental Apiary of the British Bee-keepers' Association, Swanley, Kent.

highest sense is carried out. With this object examinations are held periodically of candidates for experts' certificates. With the co-operation of the authorities of the Horticultural College, Swanley, Kent, the Association has established a model experimental apiary there, in charge of their expert and lecturer, Mr. W. Herrod, F.E.S. Students at this college are instructed in bee-keeping, and, being duly qualified, obtain the Association certificates, by means of which some have obtained good appointments. The illustration on page 3 shows this apiary, as well as the house where the appliances are kept and in which the oral examinations are held. As an instance of the high efficiency of the instruction given, it may be mentioned that all the student candidates in the group on page opposite "Contents" obtained their third class certificate at one examination, and some have passed their second and first class examinations since the photograph was taken. One of the young gentlemen in the back row is now a teacher in a technical college, and another of the gentlemen obtained the highest record marks in all the three examinations.

The British Bee-keepers' Association holds annual shows in connection with the Royal Agricultural Society, at which silver and bronze medals, certificates, and money prizes are awarded for honey and bee-keeping appliances, and where its Bee Tent (see page 203) draws hundreds of visitors to witness the manipulations with live bees and to hear the lectures given by its expert. The affiliated County Associations hold exhibitions of honey and bee produce at agricultural and horticultural shows in all parts of the kingdom, and have their own bee-tent and lecturer. Their experts also visit apiaries of members, to give help and instruction in practical bee-keeping.

Monthly meetings are held in London by the Council

of the British Bee-keepers' Association, at which duly appointed representatives of County Associations are present, and have an equal voice with the Council in the deliberations of that body. Meetings of members and their friends are also held, when matters relating to practical bee-keeping are discussed. New inventions, too, are shown, and their merits freely detailed. Periodical examinations are also held at various centres throughout the kingdom, and gentlemen duly appointed by the Central Assocation attend for the purpose of examining candidates for certificates of proficiency in bee-keeping. In addition to the above, special examinations are held in London and elsewhere of candidates for certificates of a higher grade than those mentioned.

There are now a good number of County Associations affiliated to the British Bee-keepers' Association, and working in harmony with it; and as the benefits to be derived from association are more fully recognised, it is hoped that every county will have its own Society co-operating with the Central Association. The subscriptions are small, and every bee-keeper should contribute his share, however little, towards the advancement of the cause advocated.

In view of what has been stated above, it is much to be regretted that the usefulness of the British Bee-keepers' Association is restricted by insufficiency of funds for the increasing work it is called upon to do. As the parent body recommends persons to join their County Association for local reasons, it would be well for those in the counties who are in a position to do so to render help to the parent Association, for the purpose of extending the work for the general benefit, by contributing to its funds and becoming members. The Secretary, Mr. E. H. Young, 12, Hanover Square, London, would furnish all particulars.

Bee-keeping has made rapid progress since the formation of these Associations. The old straw skep of our forefathers—well illustrated on opposite page—as compared with the modern frame-hive, as well as the ignorance and superstition connected with it, is steadily dying out; and since the introduction of the movable-comb hive, bee-keeping has come to be regarded in a more favourable light and to receive more attention. Modern hives are now considered by practical bee-keepers to be indispensable to profitable apiculture, as placing bees under the complete control of the bee-master.

Beyond the frame-hive, however, in progress of time, and as experience has been gained, many most useful appliances have been introduced, all tending to save labour either to the bees or the bee-master, and thus helping to increase the latter's profit. Foremost among these aids to successful bee-keeping may be mentioned the honey-extractor, by means of which full combs of honey may be removed from the hive, emptied of their contents, and returned (uninjured) to the bees, to be by them refilled, and the operation repeated so long as the season lasts. Second, and hardly less in importance, stands comb-foundation, a most useful invention, and indispensable for profitable bee-keeping. With it we can save at least one-half of the work of the bees and make use of our old wax, get straight and more uniform combs, and can avoid drone-comb when not wanted. Passing onward, we find many appliances—all more or less useful to the bee-keeper—which will be described in succeeding pages; the selection of the most suitable for each one's requirements being, of necessity, left to the discrimination of the reader.

In selecting, difficulties will present themselves to the novice; but by visiting any of the numerous shows

Ancient and Modern Bee-keeping—Father and Son. A Contrast.

held during the summer season, he may see hives and appliances of every kind, and by conversation with experienced bee-keepers, will be assisted in making a fair start. If possible, he should also visit the apiary of some successful bee-keeper, where, in a short time, more about practical management of bees may be learned by observing the manipulations of a skilful bee-master than from many hours of reading.

Those who wish to keep pace with the times will also read the current bee-literature of the day, or at least take in the *British Bee Journal*—the only weekly periodical in the world exclusively devoted to bee-culture —or its monthly issue, the *Bee-keepers' Record*. These two publications are conducted by the author of this "Guide Book," assisted by Mr. W. Broughton Carr, who, with an efficient but entirely voluntary staff of able contributors, are at all times willing to afford information on bee-management as the season goes on, while in their pages will be found useful directions for the guidance of learners.

Every bee-keeper should also keep a record of his observations and operations, so as to prevent mistakes, which might occur in trusting to memory. To facilitate these observations the author has prepared "The British Bee-keepers' Practical Note-book," a pocket companion which enables the reader to simplify and methodise the various entries in the history of his stocks.*

It must not be supposed that all the appliances described in this work are absolutely necessary; in fact, the fewer articles—consistent with efficiency—that can be made to answer the purpose, and the simpler they are, the more does it go to prove the

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* Published at the *British Bee Journal* Office, 8, Henrietta Street, Covent Garden, London, W.C.

thorough bee-master. Such appliances as are illustrated in these pages are those in use by one or other of our best and most practical bee-keepers. One thing, however, we do most strongly advise—viz., to studiously avoid anything like multiplicity of style in the appliances used. There should—so far as possible—be uniformity, so that what is used in or upon one hive may be interchangeable with every hive in the apiary.

Lastly, persons intending to keep bees should bear in mind the important fact that bee-culture is a business to be learnt like any other trade or profession, and success depends in a marked degree upon knowledge and experience.

II.—NATURAL HISTORY OF BEES.

All who aspire to become successful bee-keepers should be well informed regarding the natural history of the bee. Full particulars of its anatomy and physiology will be found in "The Honey Bee," by the author of this work,* to which readers are referred; it will, therefore, be only necessary here to glance briefly at the internal economy of the hive.

A prosperous colony of bees at the beginning of the swarming season consists of a fertile queen, a few hundred drones, and from thirty to fifty thousand workers. The mother-bee, or queen, as she is usually called, is a perfectly developed female, and deposits all the eggs from which the other bees are produced. These eggs are of two kinds; the one develops into drones, and the other, under ordinary treatment,

* "The Honey Bee: Its Natural History, Anatomy, and Physiology." (Madgwick, Houlston, and Co., Ltd., and *British Bee Journal* Office.)

produces worker-bees, which are undeveloped females; but the same eggs, under different treatment and care, produce perfect females or queens.

THE QUEEN (Fig. 1) will live from three to four years if allowed, and is distinguished from the other bees by her form, size, and colour, being longer, darker,* and of more slender structure, with comparatively shorter wings than either drone or worker. As but one queen (except in rare instances) is allowed in a hive at one time, young queens are only reared when a colony is either deprived of its queen, is about to swarm, or if, through age or other causes, the fertility of the mother-bee ceases. Usually in from three to five days after birth the young queen leaves the hive for fertilisation by the drone, or male bee, and when this is once accomplished, it suffices for life, as ordinarily she never afterwards leaves the hive, except when accompanying a first swarm. About forty-eight hours after fertilisation she begins to lay. If her death occurs, or she from any cause becomes unproductive at a time when there are young worker brood or eggs in the hive, the workers construct larger cells, called queen-cells (Fig. 8), round the young larvæ, supply them with an abundance of special food, and what would otherwise produce worker-bees are thus developed into queens. Should the queen not deposit eggs in any of the queen-cells, the bees will supply them with eggs carried from worker-cells. If there are no worker-eggs, queen-cells are sometimes constructed around drone-eggs; but these will not produce

Fig. 1.—Queen.

* This description refers only to the common black species. The Ligurian queens are described on page 142.

queens, and are recognised by being smoother than genuine queen-cells. If a queen from any cause fails to become fertilised, she will only lay drone-eggs. The queen is capable of laying as many as from two thousand to three thousand eggs a day when in her prime—*i.e.*, from one to two years old—after which her laying powers decrease. She has also a curved sting, but only uses it when contending with a rival.

Fig. 2.—Drone.

THE DRONES (Fig. 2) are more bulky than the queen, and larger than the worker-bee. They have no sting, lead an idle life, and, with the exception of assisting to keep up the temperature of the hive, do not work for the support of the colony, but live by the labour of the workers. They are called into existence at the approach of the swarming season to fertilise the young queens. At the end of summer, when the honey flow ceases, or when no longer needed, food is withheld from them by the workers, and they are killed or driven forth from the hive to perish (see page 206).

Fig. 3. Worker.

THE WORKERS (Fig. 3) are smaller than either queen or drones; they are, moreover, so well known that a minute description would seem superfluous. Upon them devolves the whole work of collecting and defending stores, building combs, feeding and protecting the queen, brood, and also feeding the drones. They rule and regulate the whole economy of the hive, performing all its offices except those having direct reference to the reproduction of the species. During the summer months the workers seldom live more than from six to eight

weeks, owing to the hard work they have to perform; but worker-bees hatched in the autumn generally live through the winter, and commence the work of the hive in the spring.

The following table has been arranged, and will be found useful as showing at a glance the usual periods —which, owing to climatic influences, vary slightly— of the various transformations of bees from the egg to the perfect insect:—

METAMORPHOSES OF BEES.

	Queen. Days.	Worker. Days.	Drone. Days.
1. Time of incubation of egg	3	3	3
2. Time of feeding the larvæ	5	5	6
3. Spinning cocoon by larvæ	1	2	3
4. Period of Rest	2	3	4
5. Transformation of larvæ into nymphs ...	1	1	1
6. Time in nymph state	3	7	7
Total	15	21	24
	Day.	Day.	Day
7. The cell is sealed over on the	9th	9th	9th
8. The bee leaves the hive to fly on the ...	5th	14th	14th

By the above table it will be seen that an egg deposited by a queen in a cell prepared by the workers hatches into a small grub in three days; it is then fed and cherished until about the ninth day, when it becomes a nymph, and is sealed up in its cell to emerge a perfect bee. The workers mature in twenty-one, the drones in twenty-four, and the queens in from fourteen to seventeen days from the time the egg is laid.

FERTILE WORKERS.—These physiological curiosities of bee-life sometimes appear in hives which, besides being queenless, no longer have the requisite means of raising a queen to replace the one lost. The "fertile worker"—though at best an imperfect female bee —possesses certain powers of reproduction in so far as she is capable of laying eggs from which only drones can proceed. Unlike the queen, whose eggs

are deposited singly and regularly in the cells in compact masses, the fertile worker lays her eggs in small, irregular patches, as seen in Fig. 4, which is photographed from nature, several being often found in single cells here and there, whilst most of those adjoining are empty and unused. It need hardly be said that they are considered a pest in the apiary, and should be got rid of without delay as soon as their presence is discovered (see page 123). So long as a fertile queen is present in the hive the bees will rarely tolerate a fertile worker.

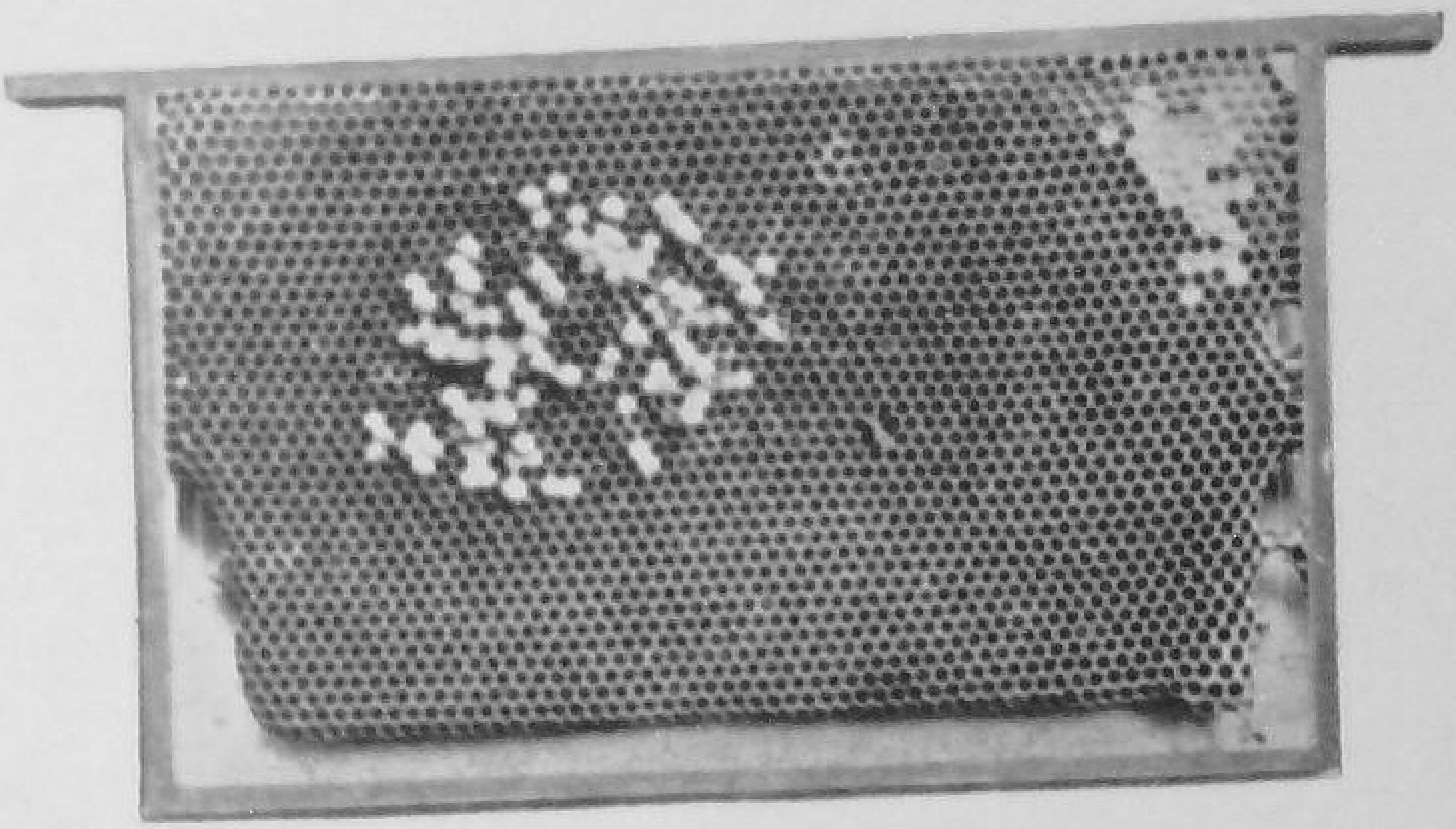

Fig. 4.—Brood of Fertile Worker.

HONEY-COMB (Fig. 5), which is made by bees from a fatty substance known as wax (described on page 15), consists of six-sided cells. That in which worker-bees are bred goes by the name of worker-comb; the portion containing only cells in which drones are reared being called drone-comb. Worker-cells are smaller than those of drones, five of the former measuring 1 inch in width. The thickness of such comb, having two cells with one base between, measures about seven-eighths of an inch. Drone-cells are larger, four

measuring one inch, the thickness of the comb being one and a quarter inches. There are 28.86 worker and 18.47 drone-cells to a square inch on each side. Where both sizes of cells are built on the same comb, irregular-sided intermediate ones (transition cells) are built between them. Both sizes of cells, varying greatly in depth, are used for storing honey.

The cappings of honey-cells consist of wax only, whereas those of cells containing brood consist of a mixture of wax and pollen, and are more porous in their nature than those of the former.

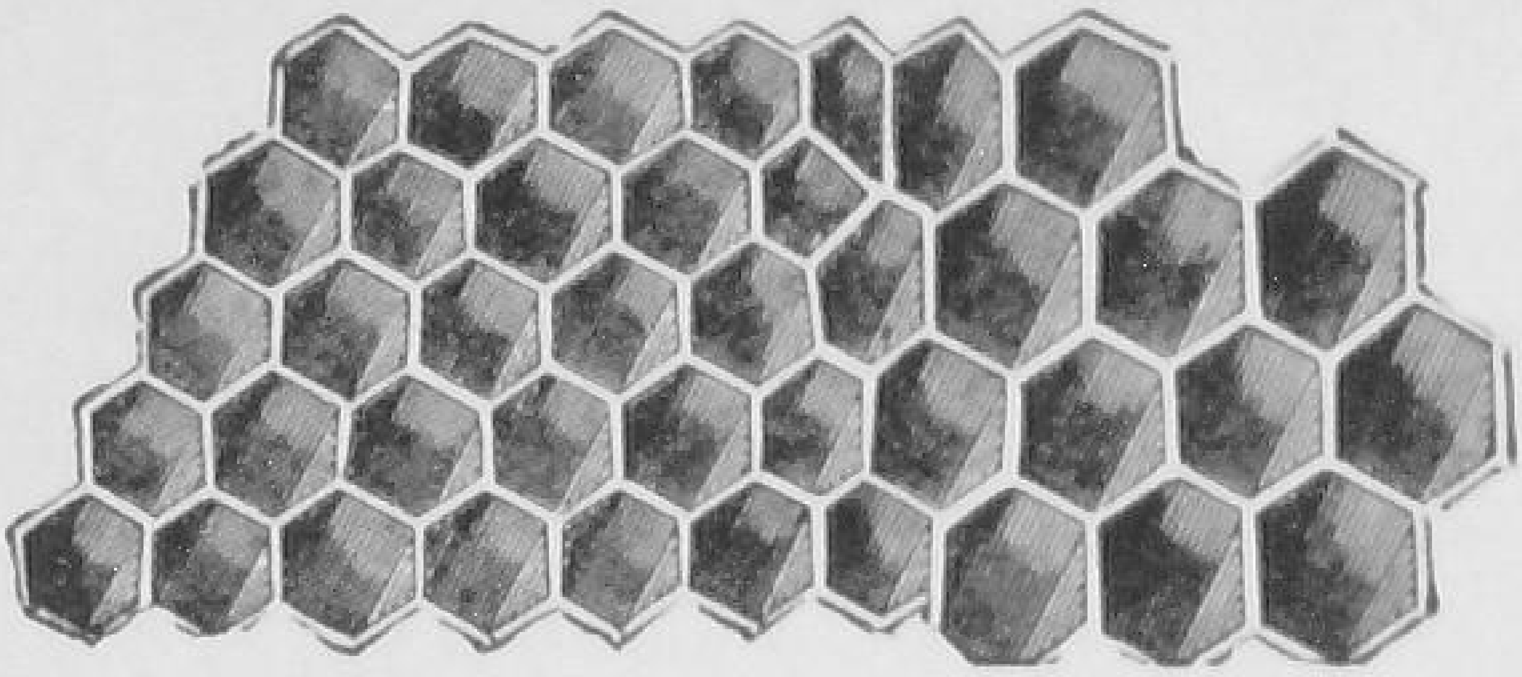

Fig. 5.—Worker and Drone Comb.

Queen-cells (Fig. 8), as will be seen, differ very much in form from both the above, somewhat resembling an acorn in shape, about an inch in depth, and one-third of an inch in diameter. Made from a mixture consisting of wax and pollen, they are covered with a number of depressions, which give the cells greater strength. The walls of queen-cells are thick and porous, requiring in their construction much wax, which, when the queen has hatched out, is used elsewhere, and the cell is cut down by the bees until it resembles a small acorn-cup. Queen-cells usually hang with their mouths downwards, while all other cells open sideways, and have a slight inclination upwards. The cell on the left (see page 17) shows the capping open after queen has passed out.

WAX is a secretion, produced in the body of the bee, not gathered (Fig. 6). It has been estimated that from 13 to 20 lbs. of honey are consumed in producing a pound of wax. The weight of empty comb required to fill an ordinary-sized hive is about 2 lbs.; so that, taking into consideration the time lost by the bees while building comb, which might be otherwise employed in gathering honey, it would make each pound of wax equivalent to between 17 and 25 lbs. of honey. From these figures the bee-keeper can judge the value to him of good combs,* and the importance of preserving them for future and continuous use.

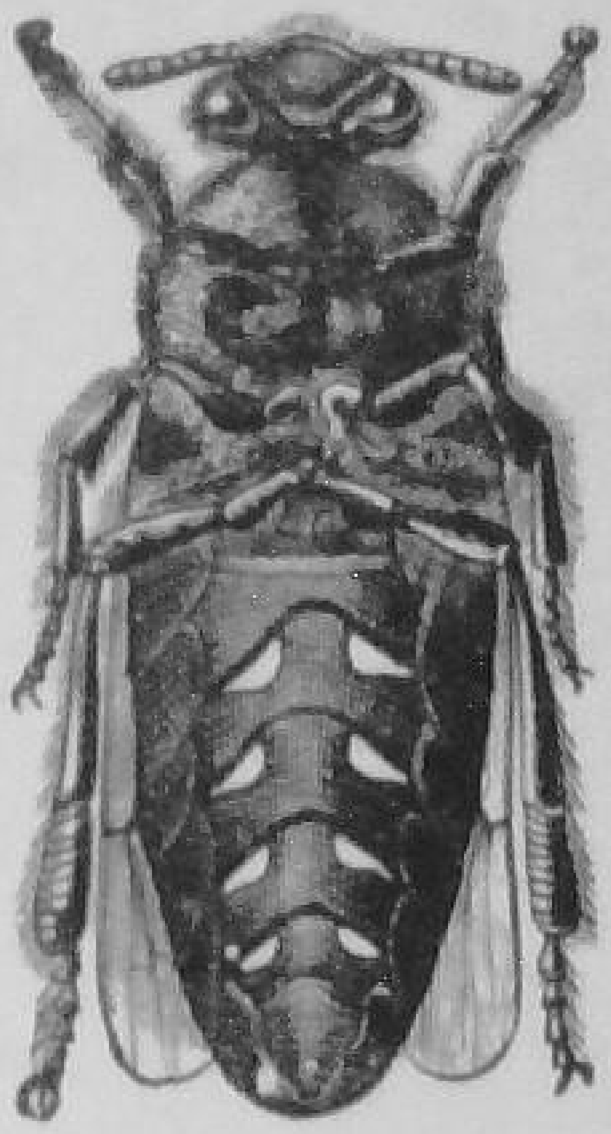

Fig. 6.—Wax Scales on Abdomen of Worker-bee.

POLLEN is the fertilising dust of flowers, gathered by bees, and after being by them moulded into ball-shape, is borne on their hind-legs to the hive, and afterwards used by them in the preparation of food for the nourishment of the young grubs. A small portion of pollen is also used by the mature bees, along with their principal food of honey, and for mixing with the wax used for queen-cells and the capping of brood-cells. Pollen not required for immediate use is closely packed in the worker-cells for future need, and for preservation is often covered with honey, and capped over with wax.

PROPOLIS is a resin-like substance obtained from buds and limbs of trees, especially from the horse-chestnut and the different kinds of pine. It is carried,

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* Experiments of M. de Layens show that under certain conditions bees may consume as little as 6.3 lbs. of honey to produce 1 lb. of wax.

like pollen, on the hind-legs of the bees, and is used to seal up every small crevice about the hive.

III.—BROOD-REARING.

Colonies of bees in good health and condition, with plenty of food in store, usually begin breeding in the latter part of January, the first batch of brood occupying a small circle in the centre of the cluster of bees. As this circle enlarges, smaller ones are begun on adjoining combs, the patches of brood spreading more

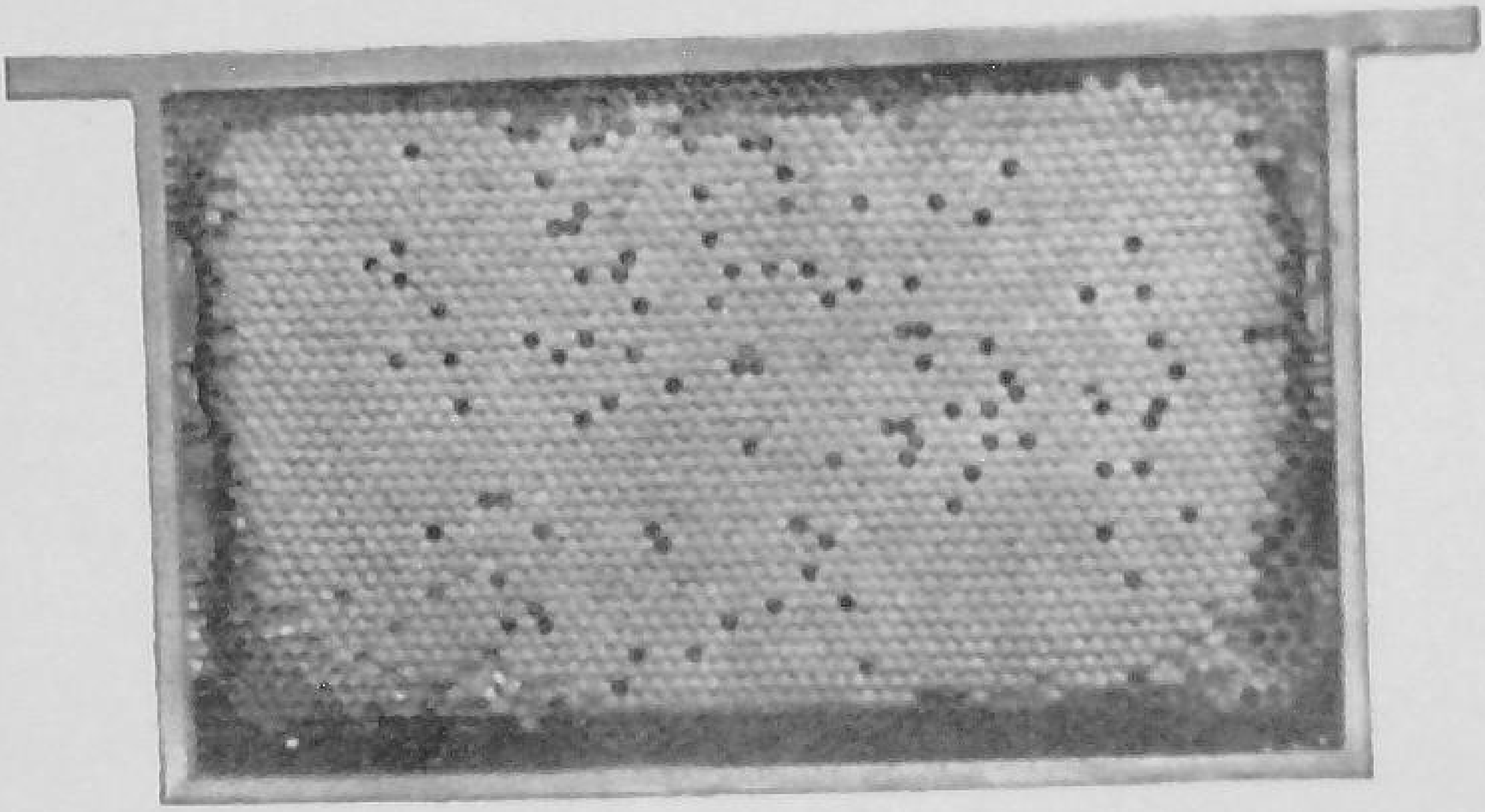


Fig. 7.—Brood-comb. An Ideal Specimen from Nature.

and more as spring advances, and according to the strength of the colony, until nearly all cells not occupied by pollen or honey are filled with eggs, larvæ, or by rapidly hatching bees (Fig. 7). After the swarming season is over, the amount of brood decreases until about November, when breeding for the year generally ceases. As already stated, the brood of a fertile queen is compact and uniform, as shown in the excellent

specimen of how a comb from brood nest ought to be filled, while that of a fertile worker is scattered, like that shown on page 13. The caps over the latter project nearly an eighth of an inch.

The object of the bee-keeper is to have his stocks always strong, and for this reason he will keep them, except in winter, constantly breeding by stimulative feeding (see "Feeding," Chapter XXI.).

IV.—NATURAL SWARMING.

If the weather be mild early in spring, with hives strong, and food plentiful, brood is generated very rapidly, and about the time apple-trees are in full bloom, natural swarms begin to leave their hives.

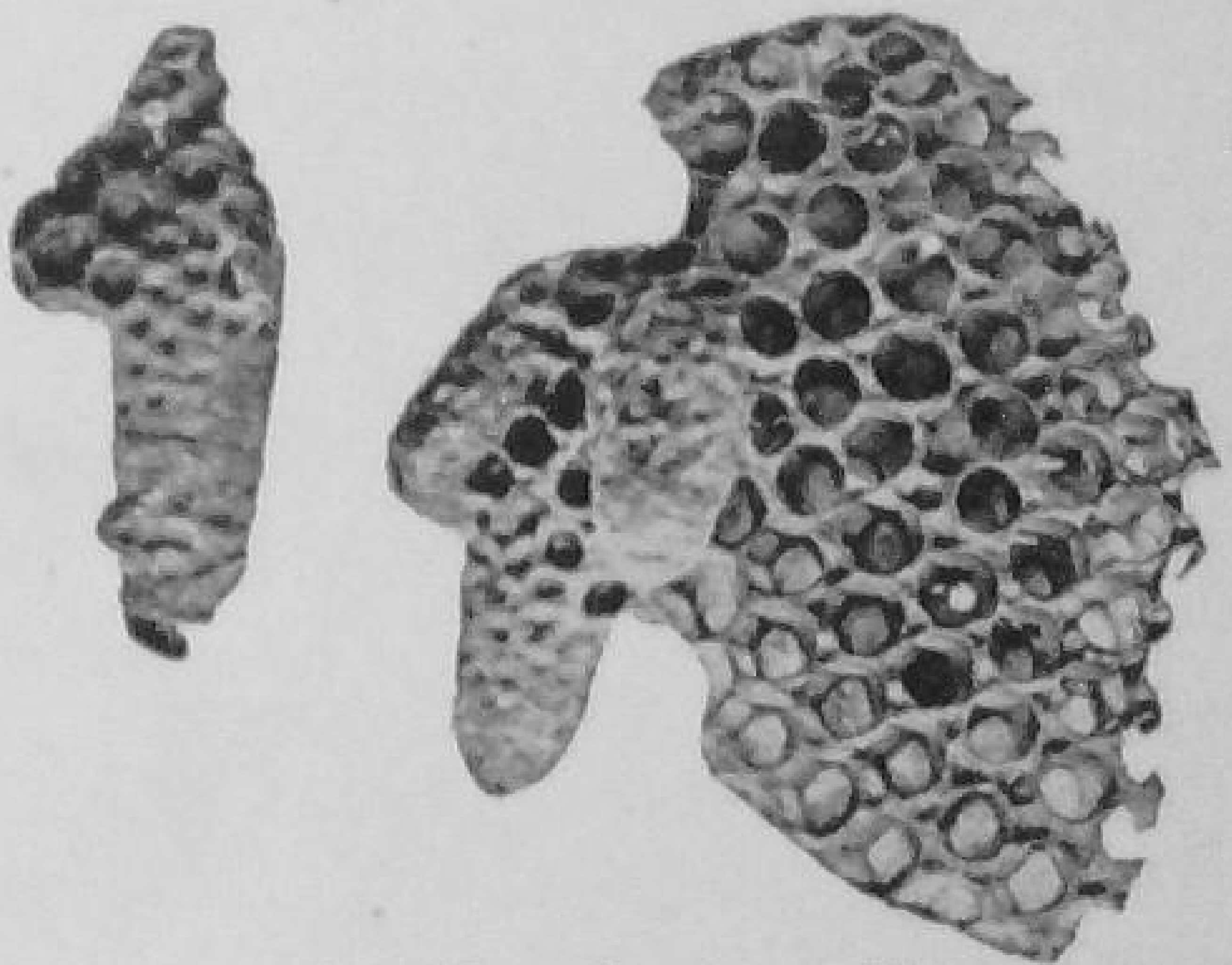


Fig. 8.—Queen-cells.

This generally takes place about the end of May or beginning of June; but, in some instances, when the spring is unusually mild and favourable, swarms will issue as early as the beginning of May or the end of

April. In the Midlands and further north the time varies from mid-June to July.

The usual signs of the approach of swarming are the crowded condition of colonies, the sight of drones on the wing or in the hives, and the building of queen-cells. The latter can be easily found in a frame-hive by taking out the central combs and carefully looking along their edges or among the clusters of bees for cells having the appearance of those shown on page 17 (Fig. 8). Should any of these be found capped over, the swarm may be expected before long. Bees on the point of swarming are frequently prevented from doing so by a few days of rainy or cold weather, in which case the queen-cells are destroyed, and swarming checked until a second set are prepared, often causing a delay of some weeks; and, in some instances, the bees do not swarm at all that season. There is no mistaking the issue of a natural swarm; the bees leave the hive like a liquid stream, they appear almost frantic, rushing out pell-mell over each other in such large numbers that the atmosphere seems alive with tens of thousands of bees circling around overhead in a condition of joyful enthusiasm which rarely fails to communicate itself to the on-looking bee-keeper. The swarm will generally settle on some bush or tree at a short distance from the hive, and should not be disturbed until most of the bees have joined the cluster and have become quiet. First swarms are accompanied by the old queen, and usually leave the hive on a fine day between ten a.m. and four p.m. Should the queen not join the bees when clustered, they will return to the old hive. Swarms sometimes, although very rarely, are disinclined to cluster; and when it is seen that, instead of clustering near the ground, the bees rise higher and higher into the air, the bee-keeper should endeavour to arrest their movements

Hiving a Swarm under Difficulties.

by throwing water from a syringe over them in such a manner as to resemble rain, otherwise they may decamp entirely and be lost, or cluster on the top of a high tree out of reach, rendering the task of hiving very difficult (see preceding page). Sometimes two or more swarms will issue simultaneously, and join together of themselves; when this occurs they should be treated as one, not separated, and the increased strength of the swarm will amply repay the bee-keeper at the honey harvest. If he wishes to preserve one of the queens, she must be found and secured at the time of hiving the bees.

The careful bee-keeper will always endeavour to have fertile queens in readiness (see page 123), and much time will be saved by destroying all the queen-cells in newly-swarmed hives and introducing a laying queen to the stock from which the swarm has issued (see "Introducing Queens," page 135).

V.—AFTER-SWARMS, OR CASTS.

Assuming that the bees remaining in the hive after a first swarm has issued have prevented the first hatched queen from destroying the young queens in the cells—after-swarms, usually called "casts," may be expected. In her attempts to destroy her rivals the young queen utters at intervals a shrill, piping sound. This is responded to sometimes by one or more young queens with a shorter note. These sounds can be heard distinctly by placing the ear close against the hive-side after night-fall. When this is heard a swarm may be expected within a day or two, as the queen, failing in her intended destruction of her rivals, rushes from the hive accompanied by a portion of the bees. Casts usually leave their hive on the ninth day after

the first swarming. They issue at almost any time of the day, regardless of weather, whereas an old queen and a first swarm will not leave the hive unless the weather be favourable. Sometimes third and fourth swarms may be thrown off at intervals, generally of one or two days.

The issue of all swarms beyond the first may—if so desired—be prevented by destroying all queen-cells and introducing another queen; or, if time does not allow of this, an almost certain method of prevention is to hive the cast in the usual way, and very early on the following morning, before work for the day has begun, prop up the entrance and return the cast, as recommended for hiving swarms, when the surplus queens will be found thrown out.

Second swarms, if early, may be made profitable as separate stocks, but subsequent ones are of little value, even in favourable seasons, and should be prevented (see "Prevention of Swarming"), for they so weaken the stock as to render it practically useless.

VI.—PREVENTION OF SWARMING.

The prevention of swarming is often very difficult, and when honey rather than increase of stocks is desired, every effort should be made to check it, seeing that once bees have got the swarming fever, no device of the bee-keeper will stop it. If steps are taken in time, it can, however, generally be prevented by giving room in the hive and supers, in advance of the requirements of the colony. Keeping the hive cool and giving plenty of ventilation also assist in checking swarming. Another way is to give the queen room for ovipositing, by removing frames containing brood and substituting empty combs, or comb-foundation, such combs being

used in forming nuclei or strengthening weaker stocks. Should the outer combs be broodless and filled with honey, additional breeding-space can be given by extracting it. Whatever plan may be adopted, the bees should never feel cramped for want of room, or

Fig. 9.—Prevention of Swarming.
The "Brice" Appliance (as fixed).

be distressed by lack of ventilation. Artificial swarming is dealt with later on (see page 93).

One of the most effectual means of preventing loss of swarms is the "Brice" appliance, shown in photos from nature (Figs. 9 and 10).

Should the bees, notwithstanding all these measures, persist in swarming and abandoning the supers, remove all the combs containing brood—brushing the adhering bees back into the hive—and substitute

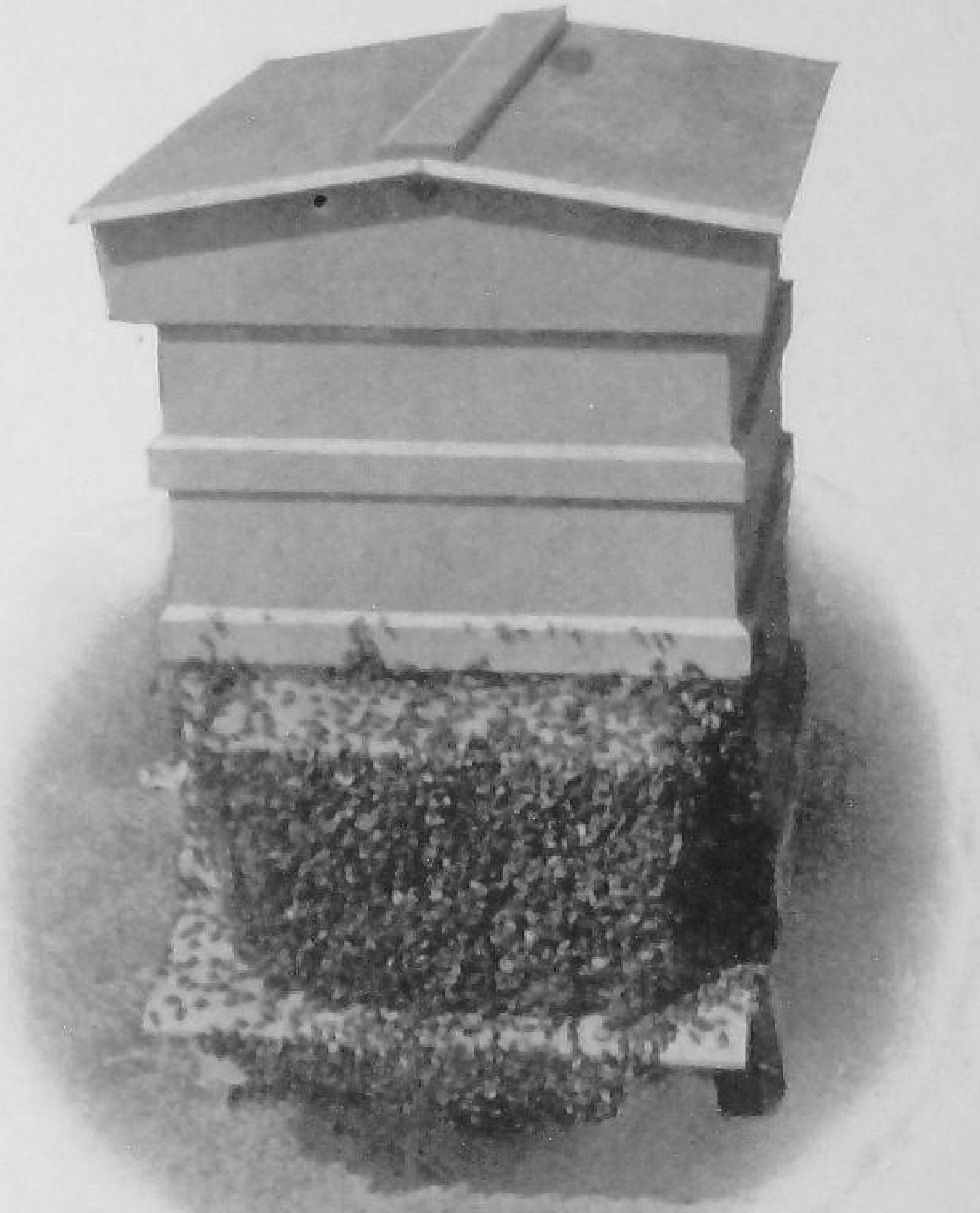


Fig. 10.—The Swarm Caught.

frames of comb-foundation and return the swarm. The combs of brood taken away must be given to other stocks to hatch out. This will generally check all further inclination to swarm, and work in the supers

will be continued. Young queens under two years are preferable to older ones, as the bees with them are less disposed to swarm. After-swarms may be prevented in frame-hives by examining the combs and cutting out all queen-cells, except the most perfect one. In due time the remaining queen in the cell will take her place as queen of that hive, and swarming be over for the year. Various methods have been devised by giving room below the brood-chamber, but so far they have not proved successful, except as a means of inducing bees to work in surplus-chambers which they would otherwise swarm rather than take to. These, when occupied by the bees, can be placed above the brood-chamber, and thus prevent swarming.

VII.—HIVING BEES.

As the season for the issue of swarms draws near, hives should always be got ready beforehand for their reception. In all cases it is absolutely necessary to fit the frames in the hive with full sheets of comb-foundation wired (see page 73). With frames so prepared, and hives set perfectly level, the bees will build straight combs, while without such aids they might, and probably would, be built across the top bars, and so be spoiled for their purpose as movable combs. (See "Comb Foundation," Chapter XII.) This is much more advantageous than giving starters or wider strips. Fig. 11 (see next page) forcibly illustrates this point, the frame A being fitted with a starter only, B having a strip one-third the depth of frame, and C two-thirds, and in each case the bees immediately began to build drone-cells when they got clear of the foundation. If the bee-keeper has frames of empty comb to spare, a few of them may be advantageously given, putting one

comb between two frames of foundation. This giving of empty combs enables the queen to begin egg-laying at once.

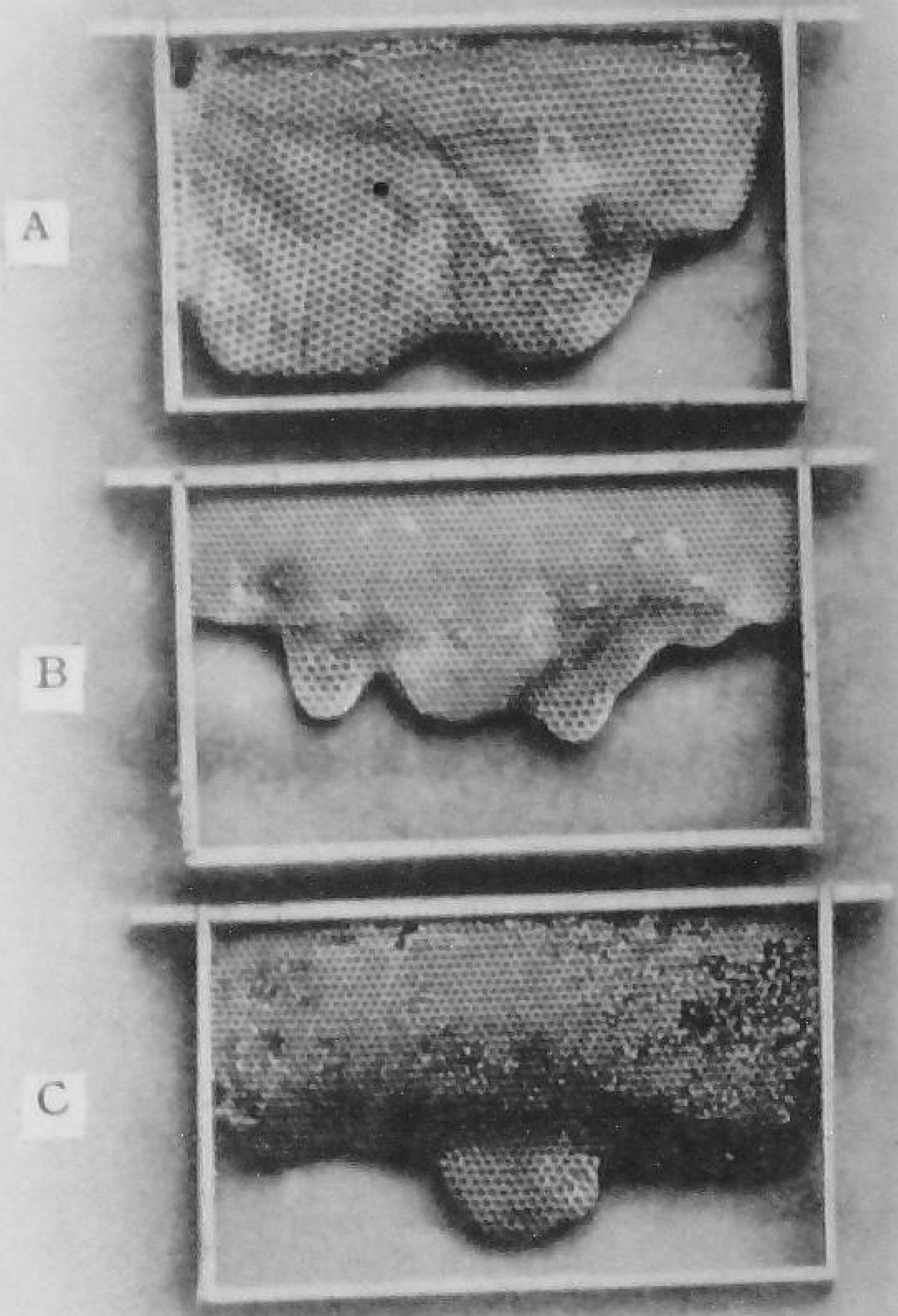


Fig. 11.—Use of Comb-foundation.

The frames, too, besides being secured firmly in their places, require fixing at the proper distance apart, viz.,

a shade under one and a half inches from the septum or midrib of each pair of combs. Advanced apiarians, here and in America, relied on the eye and finger alone for correctly spacing the combs, but in this country it was found preferable to have some mechanical means of spacing. Staples, wire nails, distance racks, and close-ended frames were tried some twenty years ago, all of which have been discarded, the two distinct types now being metal ends and broad-shouldered frames. These are illustrated on pages 46 and 200.

When the frames have been seen to, lay on the quilt—consisting of a square of "ticking" or of unbleached calico—and a light square of drugget or flannel. The day after hiving a couple or more squares of drugget may be added. In the spring and summer American cloth is also used. The precise method followed in hiving swarms in frame-hives will, of course, depend on the circumstances of the case; but as a general rule—and passing over the exceptional difficulties under which the operation of hiving is occasionally performed—two plans, which we will call respectively (*a*) and (*b*), will suffice for all ordinary purposes. The first (*a*) is where it is proposed to carry the frame-hive bodily to the place where the swarm has settled and hive the bees directly into it. The second (*b*) where the swarm, after being hived temporarily into a skep, is—either at once or some hours later—carried to the spot where the frame-hive stands, and there the bees are thrown out in front, as shown on next page (Fig. 12), see also page 106.

Supposing plan (*a*) to be chosen: if the bees have clustered on a bush near the ground, first sprinkle them with cold water from a garden syringe; this will cool them, and close clustering will be the result. Spread a cloth or sheet directly under the cluster, and at one end of it place a floor-board, bringing the end

of the sheet over the edge of the board, and on this place the hive prepared to receive the swarm. Raise the front of the hive about 1½ inches, by means of a block of wood placed on the board under the edge of the hive. Care should be taken to have the frames hung at right angles to the front of the hive; otherwise the weight and heat of the bees would displace the comb-foundations, and possibly they would break away from

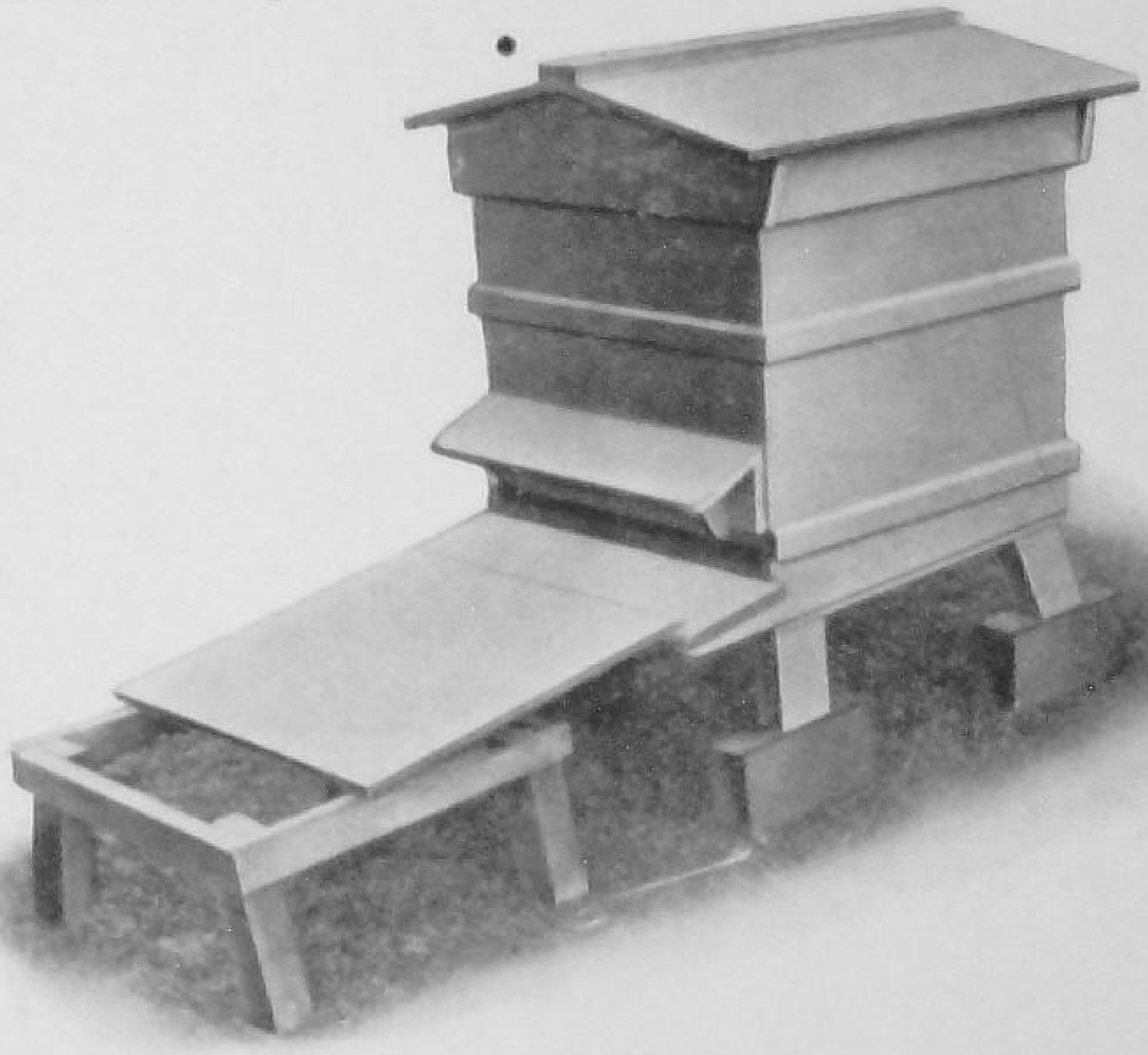


Fig. 12.—"W.B.C." Hive Prepared for Receiving Swarm.

their attachments to the top bars of the frames. The front of the hive should be as near as it is possible to get it to the cluster. If the branch on which the bees have clustered is small and not valuable, cut it off, carefully avoiding all jarring; shake the bees on to the sheet in front of the hive, and they will quickly enter it. The straggling bees on the sheet and those flying about will soon join the rest; and, when

they are all in, carefully remove the block and the sheet, and lower the front of the hive on to the floor-board. Now take hold of the floor-board with both hands, carry the hive steadily, and place it on the stand it is intended to occupy for the season. Adjust the hive, giving the floor-board a slight inclination forward, taking care that it is perfectly level *across* the combs. If the frames be not hung perpendicularly the combs will not be built properly within them, but will project beyond at the lower extremity, and there will thus be a difficulty in manipulating them. If the combs are to hang parallel with the entrance, turn the hive on the board; but in this case it must stand perfectly level. Or, if it is decided that they should be in this position, turn the hive round on the floor-board, prop up the side with the block, and hive the bees at the side. When the hive is adjusted, place a bottle of syrup over the feed-hole in the quilt. Replace the outer-case and cover, and do not disturb the bees until the next day, when the hive may be examined. Blow a little smoke into the entrance, and at the top in removing the quilt, contract the hive by the division board to the frames covered by bees, placing the others in the outer space. (For further management see "Feeding," page 108.)

If the second plan (*b*) is preferred, and the bees have clustered on the branch of a tree too valuable or too thick to cut off, shake them first into a straw skep, held bottom upwards in one hand under the cluster; and with the other give the branch a smart shake so as to dislodge the bees into it. Invert the skep, and set it on a board as near as convenient to the spot where swarm clustered. Leave it there a short time for all the flying bees to gather in. Meantime arrange the frame-hive for getting the bees into it, according to the particular form of hive used. On page 27 is shown

one method in which the hive—though on a floor-board separable from its stand—is not removed from the

Fig. 13.—A Swarm Hiving Itself.

latter, but left in its ordinary and permanent position, a temporary platform being made by the use of a good-sized board and a spare hive-stand. The hive

front is raised an inch by using the sliding doors as wedges, and the bees are thrown from the hiving skep and allowed to run in. If they alight on the trunk or branch of a tree, brush them gently into the skep, or if possible, place its edge near the upper part of the cluster, and drive them up by blowing smoke under them.

Fig. 14.—Hiving Bees.

If in addition we can fix a piece of comb containing brood inside the skep, it will induce the bees to take to it more readily. Sometimes the swarm clusters on the branch of a tree which cannot be cut off, as in Fig. 13. The skep in illustration is fixed on a temporary tripod and the bees hive themselves. If they settle on the ground, the hive should be set close to

them, and with a spoon, gently, put a few bees near to the entrance. The joyful hum of these as they enter the hive will entice others to follow, and in a short time the swarm will take up their line of march for their new home.

Fig. 15.—Bees Hiving Themselves.

A modification of this plan can be adopted by using the hive roof as a platform on which the bees are thrown from the skep. The illustration (from life) on opposite page shows a student at Swanley College hiving a swarm by this method.

The bees may also be hived in the evening, if pre-

ferred; and in this case it is better when they have settled in the hiving skep to place it on a stand as near as possible to the hive they are intended to occupy, shading them from the heat of the sun.

When swarms are hived in very hot weather, and full sheets of foundation are used, it is advisable to only cover the tops of frames very lightly for the first twenty-four hours, and to leave entrances open full width for air. After the first day the hive may be fixed up as usual.

In the case of swarms clustering on a twig or small branch of a tree, which can be removed without damage, the branch may be carefully cut off, without dislodging the swarm, and carried to the hive, previously prepared, as in Fig. 15, page 31. The bees and the twig on which they hang are then gently laid down in front of the hive, and if a spoonful of the bees are placed close to the doorway, the rest will soon follow them inside. The bees thus hive themselves, as seen in photo (taken from life), the swarm shown having been dealt with exactly in the manner described, and the bulk of the bees having already entered the hive.

Swarms should always be placed on or close to the stands they are permanently to occupy as soon as they have clustered in the hiving-skep; if left where hived until night many bees will begin work and mark the spot, and if the position be then changed, some bees will next day return to the place where the skep stood on the previous day, and finding it gone will go back to the parent hive, and thus reduce the strength of the swarm. If brought from a distance, the swarm should not be removed until the evening, when all the bees have entered the hive.

Swarms are sometimes placed on the stands occupied by the hive from which they issued, and the latter is taken to a fresh position in some other part of the

apiary. This frequently prevents after-swarms. The parent stock should be fed gently for a week or ten days to make up for loss of flying bees.

Despatch in hiving is important, as bees become more difficult to handle the longer they are out of the hive, and there is a danger of their rising and flying away.

When bees swarm they are gorged with honey and thus not inclined to sting, but it is just as well for the beginner to be protected by a bee-veil and gloves (see page 102), as giving him more confidence in manipulation. Sometimes swarms leave their hives, but if the bee-keeper can spare a frame of brood, this—placed in the hive before introducing the swarm into it—will invariably induce them to adopt their new home at once, because bees do not forsake young brood.

When swarms are hived and placed on their stands (unless they have sections on the top removed from parent stock and containing honey) commence feeding (see "Feeding," page 108).

Shade swarms from the heat of the sun while in hiving-skeps by some such contrivance as shown in illustration on page 215. All hives and floor-boards should be thoroughly scalded and painted over with either of the solutions No. 9 or 10, described in Chapter XXXIX., before using a second time.

VIII.—HIVES.

Before commencing bee-keeping it will be necessary to settle what kind of hive is to be used. This is of great importance, and should be well considered before finally deciding, because a mistake at the beginning will cause much annoyance and trouble afterwards. Bees will work in almost any sort of hive, but succeed better in those which we can from time to time adjust

to their requirements. The main object in view being to secure surplus honey, the bee-keeper should arrange his hive for this purpose, and by studying the habits and instincts of the bees he can learn to control them by adapting both the hive and management to their natural requirements.

Movable combs are absolutely necessary to the intelligent management of bees, and, properly used, give us complete control over them in such hives. By their use combs and bees are readily interchanged from one hive to another; frames of brood examined and queens inspected in a few minutes. Weak stocks may be strengthened by exchanging empty combs for frames of brood taken out of strong ones; artificial swarms may be made in any of the different ways described. Queens, too, may be reared at will, and swarming in a great measure controlled by giving additional breeding-space and cutting out queen-cells, or inserting frames of comb-foundation to be worked out into comb, the particulars of which operations will be found under their respective headings. Such hives also enable the bee-keeper to control the production of useless drones, and also to secure drones when required by introducing drone-comb. Should a colony become queenless, or the queen be a drone-breeder, an examination will reveal the fact, and another queen may be inserted. If the brood-nest be filled with honey the frames may be taken out and the honey extracted; an operation which sometimes saves a colony from perishing, for in the working season the mortality among bees is so great that, unless young ones are reared in large numbers, the colony dwindles rapidly because the queen has no room to deposit her eggs. These movable frames are more particularly useful only when we adapt them to the natural instincts of the bees.

On examining a hive it is found that worker-comb is

$\frac{7}{8}$ths of an inch to 1 inch thick; we therefore make our frames about $\frac{7}{8}$ths of an inch wide. The passages between the sealed brood-combs are usually about $\frac{3}{8}$ths of an inch, but those between sealed honey-combs are sometimes as narrow as $\frac{1}{4}$ inch. Practical experience has shown that if the frames are made so as to leave a full $\frac{1}{4}$ inch passage round the ends, the bees will keep this space clear. But if the space between the side bars of frames and the hive side is too small for a bee-passage, they will glue it up with propolis, and if much more they will fill it with comb and honey. Below the bottom a $\frac{1}{2}$ inch space may be left. By making the frames $\frac{1}{2}$ inch less in length than the inside of the hive, a passage-way of $\frac{1}{4}$ inch is left at each end, which the bees respect. If our frames are $\frac{7}{8}$ths of an inch wide, they can be placed $\frac{5}{8}$ths of an inch apart; this will make them $1\frac{1}{2}$ inches from centre to centre, although it is not indispensable that they should be exactly this distance apart; and if we wish to restrict them to the production of worker-brood only, the frames may be placed as near together as $1\frac{1}{4}$ from centre to centre.

The *outside* measurements of all frames and the *inside* measurements of all hives must be uniform. Accurate workmanship in their manufacture is of the utmost importance, as unless every frame is so made as to fit properly into any hive in the apiary, the full advantages to be derived from the movable-comb system are not secured, and great inconvenience and trouble arise.

Most bee-keepers are agreed that the best size of hive for ordinary use for producing comb-honey in sections is one which has a capacity of from 1,800 to 2,000 cubic inches. The size of the hive determines the size of the movable-comb frame; and although

much difference of opinion exists in respect of them, the solution, in the main, depends on the locality and surroundings of the apiary and the fancy of the bee-keeper (see "Standard Frame," page 39). Practical experience seems to indicate that frames should be shallow in proportion to their length, because with deep frames it is impossible to have all of them exactly perpendicular without the use of racks or some appliances at the bottom; and every practical bee-keeper will find that racks for bottom-bars — though theoretically beautiful—are obstacles to lateral movement of frames, and liable to cause crushing of bees and queen. Moreover, bees do not so readily work in supers placed above deep frames. Long shallow frames are more easily handled, besides being especially suitable for extracting, seeing that the comb is much sooner finished to the bottom than in deep ones. The vacant spaces at the sides of the hives permit the cold air to enter at ends and bottoms of frames, and in deep, narrow frames, tends to check the increase of brood, because it is less readily extended downwards than laterally.

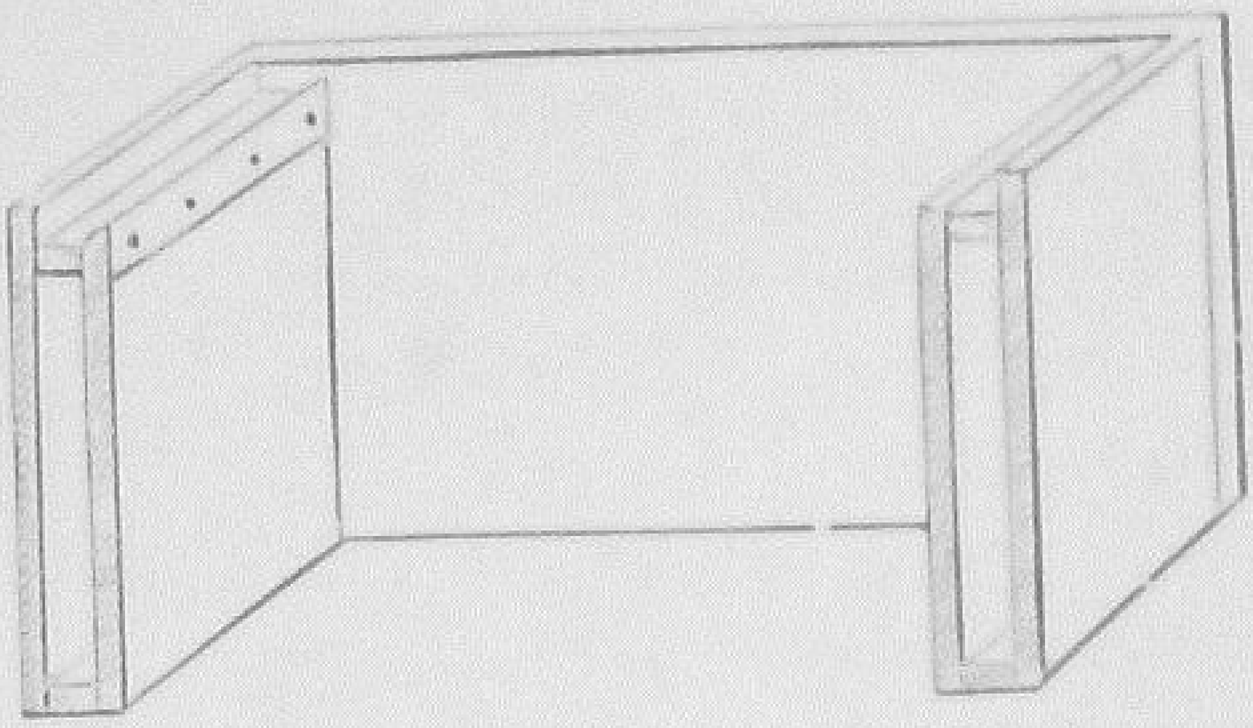


Fig. 16.—Section of Hive, showing Rabbets.

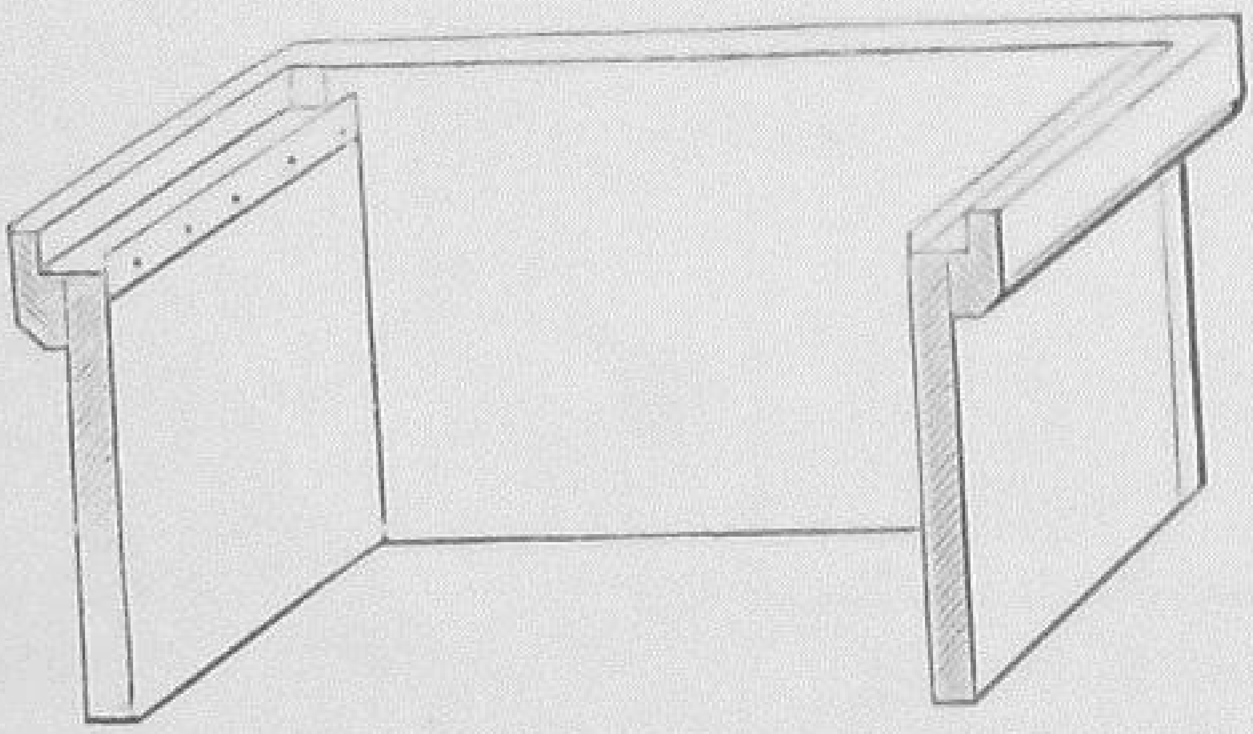


Fig. 17.—Section of Hive with Rabbeted Strip.

The tops of the hive-sides must be lowered, and rabbeted strips fitted on to receive the frame-ends, which may rest on metal runners. Strips of tin, iron, or zinc should be sunk in even with the respective sides of the hive. (See Figs. 16 and 17, on page 36.)

By having ⅜ths of an inch space under the ends of "lugs" of frames there is room to get fingerhold, and the bees are not able to fix them down so tightly, while in replacing them bees are not crushed under the ends. Instead of using the rabbeted strips as shown in Fig. 17, hives are frequently made with double walls of thinner material, on which the frame-ends rest, as shown in Fig. 16. The sides parallel to the frames are usually single walls.

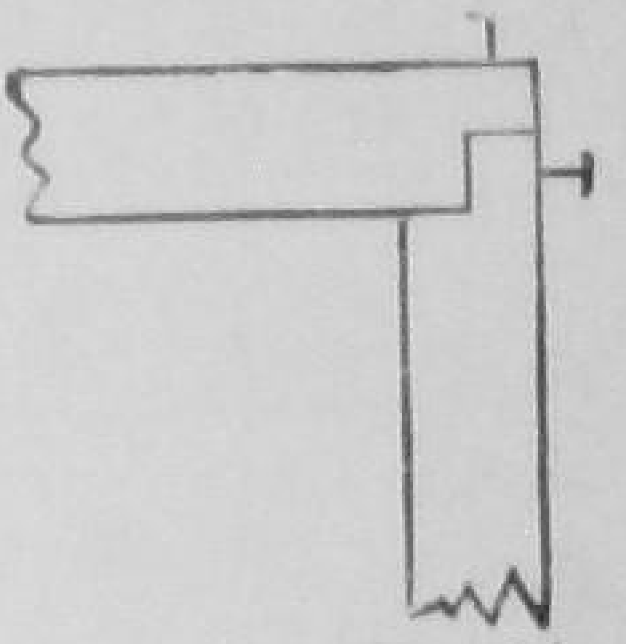


Fig. 18.—Double Rabbet-joint.

The sides of the hives should be either dovetailed (Fig. 27) or fitted with a double rabbet, as shown in Fig. 18, and nailed at both edges, this making a much stronger joint than if only nailed on one side, and not so liable to open.

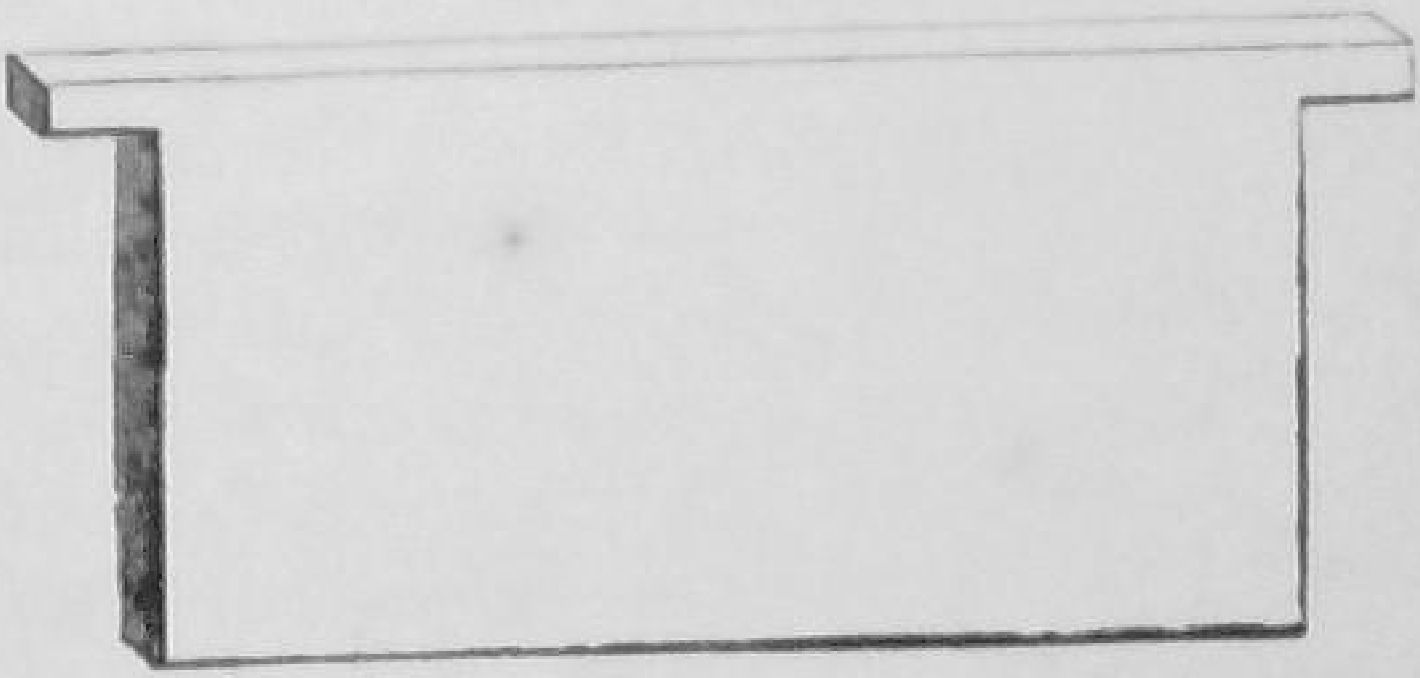


Fig. 19.—Division-board.

Movable division-boards, made to fit the hive-sides and slide on the rabbets, should be provided, as in Fig. 19. They are used to contract hives according to the strength of population. As the colony increases, the division-boards are easily moved laterally and an empty comb inserted by the cluster. By this means the heat of the cluster is utilised, and the popu-

lation increases much more rapidly. Floor-boards (Fig. 20) should be made movable, with a passage-way sunk in them about 13 inches long and $\frac{3}{8}$ths of an inch in depth. This enables the bee-keeper, if his hives are square, to place them any way he pleases; and it will be found that the loose floor-boards can be moved and exchanged more readily than those fixed to the hive. If preferred, passages may be cut in the bottom of the hive instead of in the floor-boards. The entrances should be closed more or less, as needed, by means of slides or blocks. In front of the entrance an alighting-board should extend to some considerable distance, and slope towards the ground. If

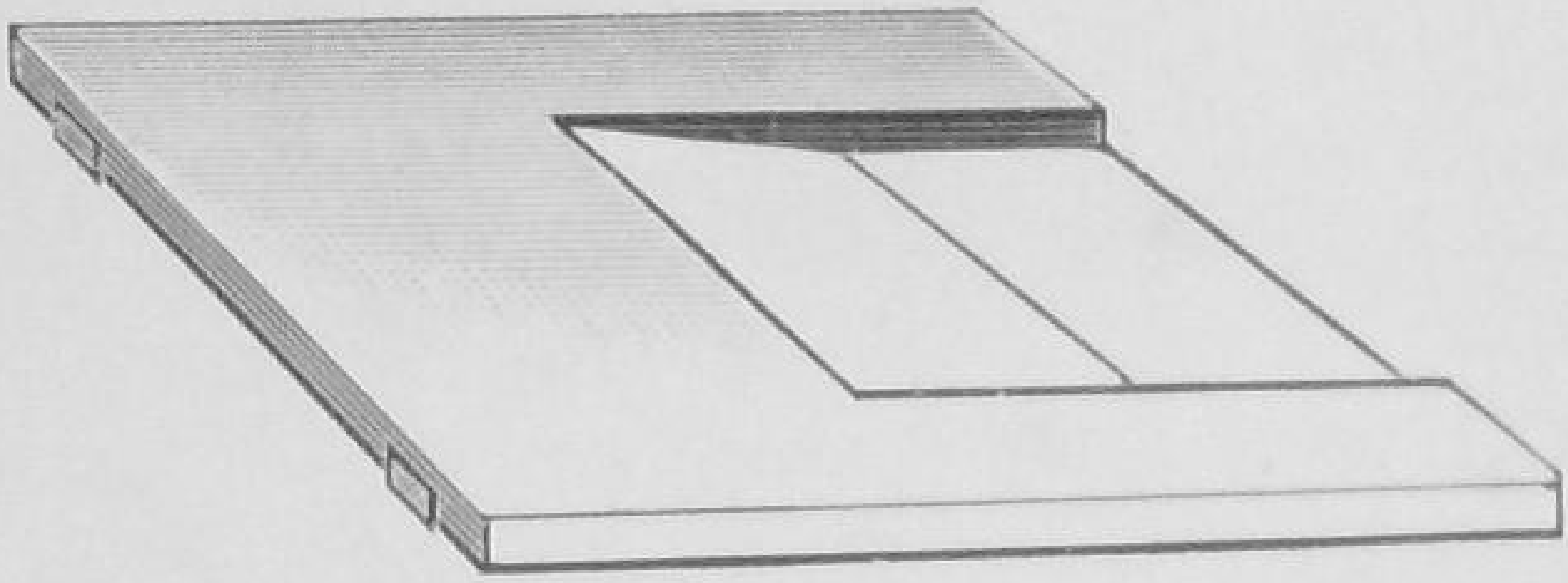


Fig. 20.—Floor-board.

intended for out-of-doors, an outer casing and roof will be required, which may be so arranged as to form double walls to the hive with dead-air space between them. Pine or yellow deal, an inch thick, planed on both sides, should be used. This will reduce it to $\frac{7}{8}$ths of an inch. The same boards are just right to make the strips for frames. These latter are $\frac{7}{8}$ths of an inch wide, and about $\frac{3}{8}$ths of an inch thick for the top, $\frac{1}{4}$ inch for sides, and $\frac{1}{8}$th of an inch for bottom. The quilts, or covering on the top, may consist first of a layer of unbleached calico or of "bed-ticking" laid on the frames, and over this should be placed two or three layers of drugget or other suitable, warm, and porous material. A hole cut in these

coverings will be necessary for feeding, and can be closed, when not wanted for this purpose, with pieces of the same material a little larger than the hole.

In offering these remarks, no particular hive has been described, and my aim has been merely to discuss the principles and advantages of a movable-comb hive, so that anyone can readily, from the management he intends to pursue, procure for himself a hive that combines with simplicity a ready adaptability to any kind of treatment he desires, whether for increase

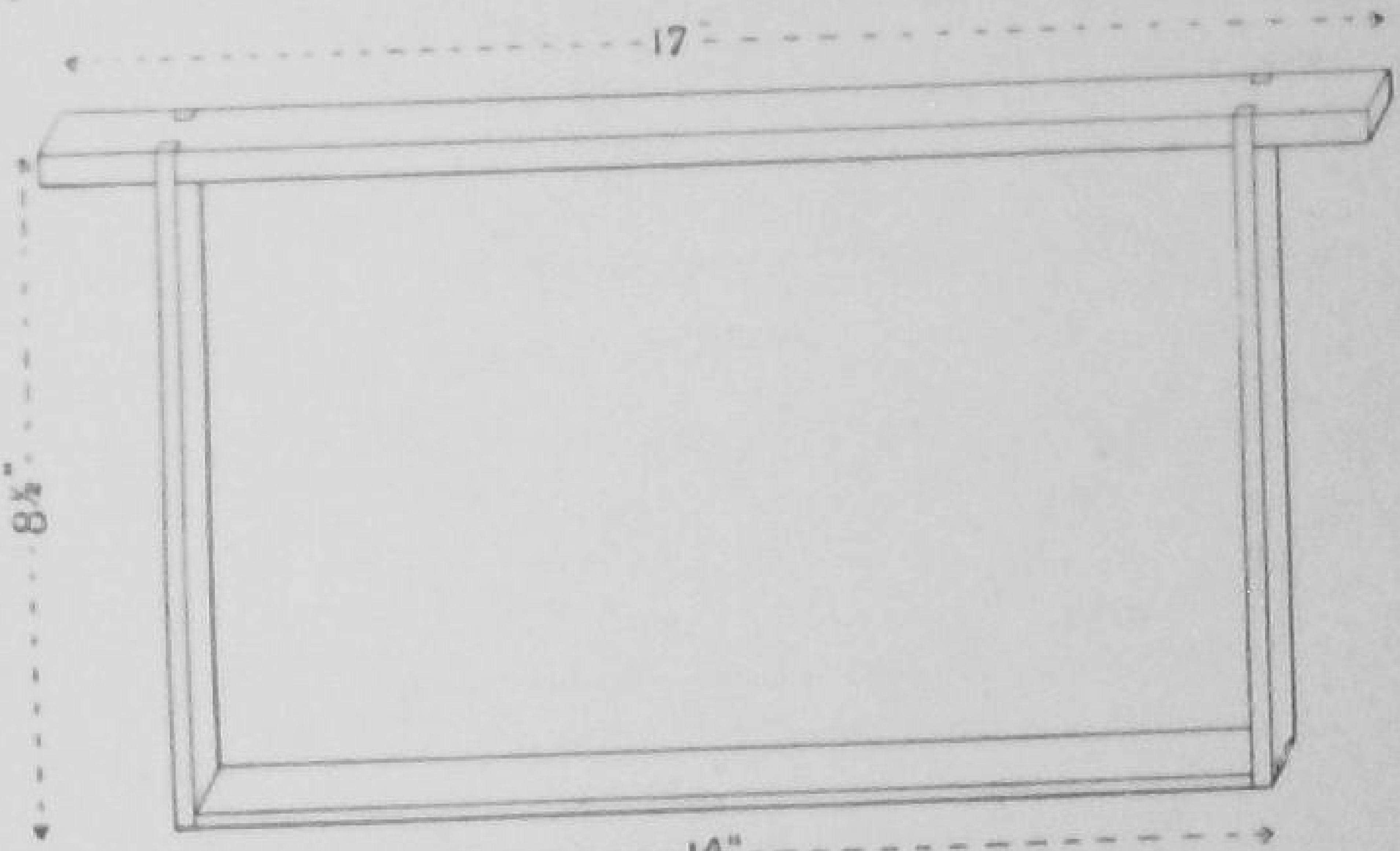


Fig. 21.—British Bee-keepers' Association Standard Frame.

of bees, comb-honey, extracted honey, queen-rearing, and any or all combined. There are so many different styles of movable-comb hives now in the market that the limit of this work will not permit of a description of all of them. A few will be noticed, as embodying the requirements stated above. One point must be insisted upon, and that is, whatever hive the bee-keeper decides to adopt, only *one size of frame* be used throughout the apiary, except for experiment.

Standard Frame.—The British Bee-keepers' Asso-

ciation has adopted a Standard frame (Fig. 21), so that now all hives, with very few exceptions, are made the proper size to contain such frames. The *outside* dimensions of the "Standard frame"—including thickness of top bar—are 14 inches long by $8\frac{1}{2}$ inches deep, the top bar being 17 inches long, $\frac{3}{8}$ths of an inch thick, the bottom bar $\frac{1}{8}$th of an inch, and the side bars $\frac{1}{4}$ inch thick, the width of all being $\frac{7}{8}$ths of an inch. The hive can be extended to take any number of these frames, but usually ten or eleven are used. There is an obvious advantage in having a uniform-sized frame throughout the country, and it is recommended that the *outside* measure of the B.B.K.A. "Standard," as given above, be adhered to and used by all. At the same time, no objection can be taken to a thicker top or stronger bottom bar where preferred.

"COWAN" HIVE.—Fig. 22 shows a section of this hive arranged for summer use. It consists of a body box, A, made of 1 inch pine, and arranged to take ten to thirteen frames. It is $14\frac{1}{2}$ inches from front to back and $8\frac{7}{8}$ inches high, inside measurement. The front and back are reduced to $8\frac{1}{8}$ inches high, and are fitted with rabbeted pieces of wood to enclose frame-ends. The inner edges are fitted with tin strips for the projecting ends of the frames to rest upon. The latter are of the Association Standard size, fitted with metal ends (Fig. 26, page 46). The inside length of a hive to take ten frames is $16\frac{1}{2}$ inches, and this leaves ample room for a division-board (Fig. 19), and two strips of wood $\frac{3}{8}$ths of an inch deep and $\frac{3}{16}$ths of an inch wide will be required, one at each end, to increase the distance between the face of comb and hive-sides in the outer frames. B is the floor-board, made out of $1\frac{1}{4}$ inch pine, and strengthened on the under-side by means of two wedged ledges let into the wood, C, in

Figs. 22 and 23. A passage, D, $\frac{3}{8}$ths of an inch deep and 12 to 13 inches wide, is cut out of the floor-board, sloping upwards towards the centre of the hive. This passage communicates with the entrance-porch, E. The outer case, F, is made of $\frac{5}{8}$ths of an inch deal 9 inches high, and rests on the floor-board, B. To prevent rain getting in at the junction between the

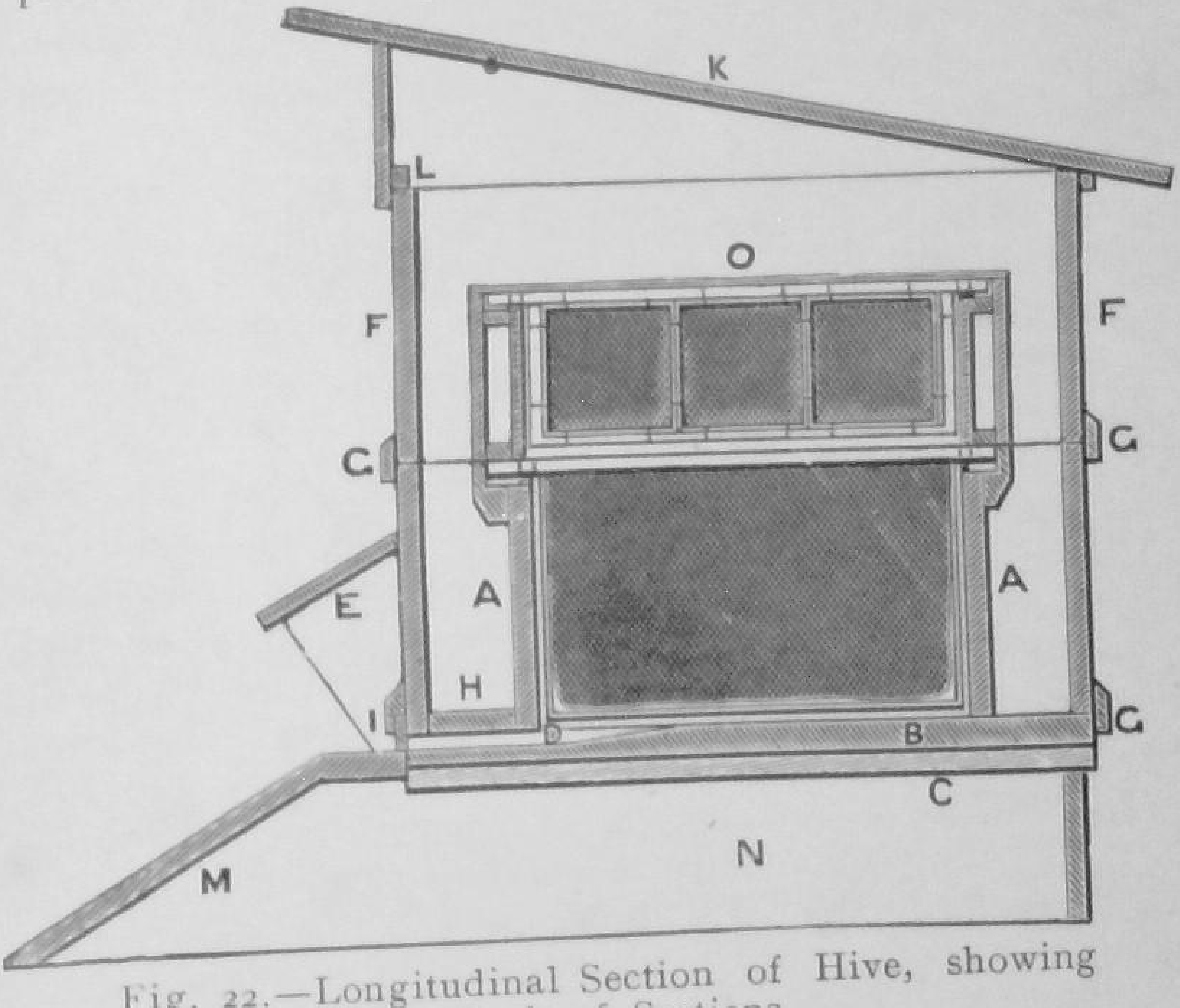


Fig. 22.—Longitudinal Section of Hive, showing Rack of Sections.

outer covering and the floor-board, plinths of wood, G, are nailed on, as shown in Fig. 22. Between the outer case and the front of the body, A, is laid a block of wood, H, which covers the passage, D, and prevents the bees getting inside the outer case. This block is loose, so that it may be removed for ventilation, or the hive can be brought close to the

outer casing when required. Beneath the porch-roof, E, which is fixed to the outer case, is secured a block of wood, I, provided with a groove to allow two shutters to slide, for the purpose of contracting or enlarging the entrance. The upper part of case, F, is similar in every way, except that it has no porch or sliding shutters. The roof, K, fits loosely over F, having an

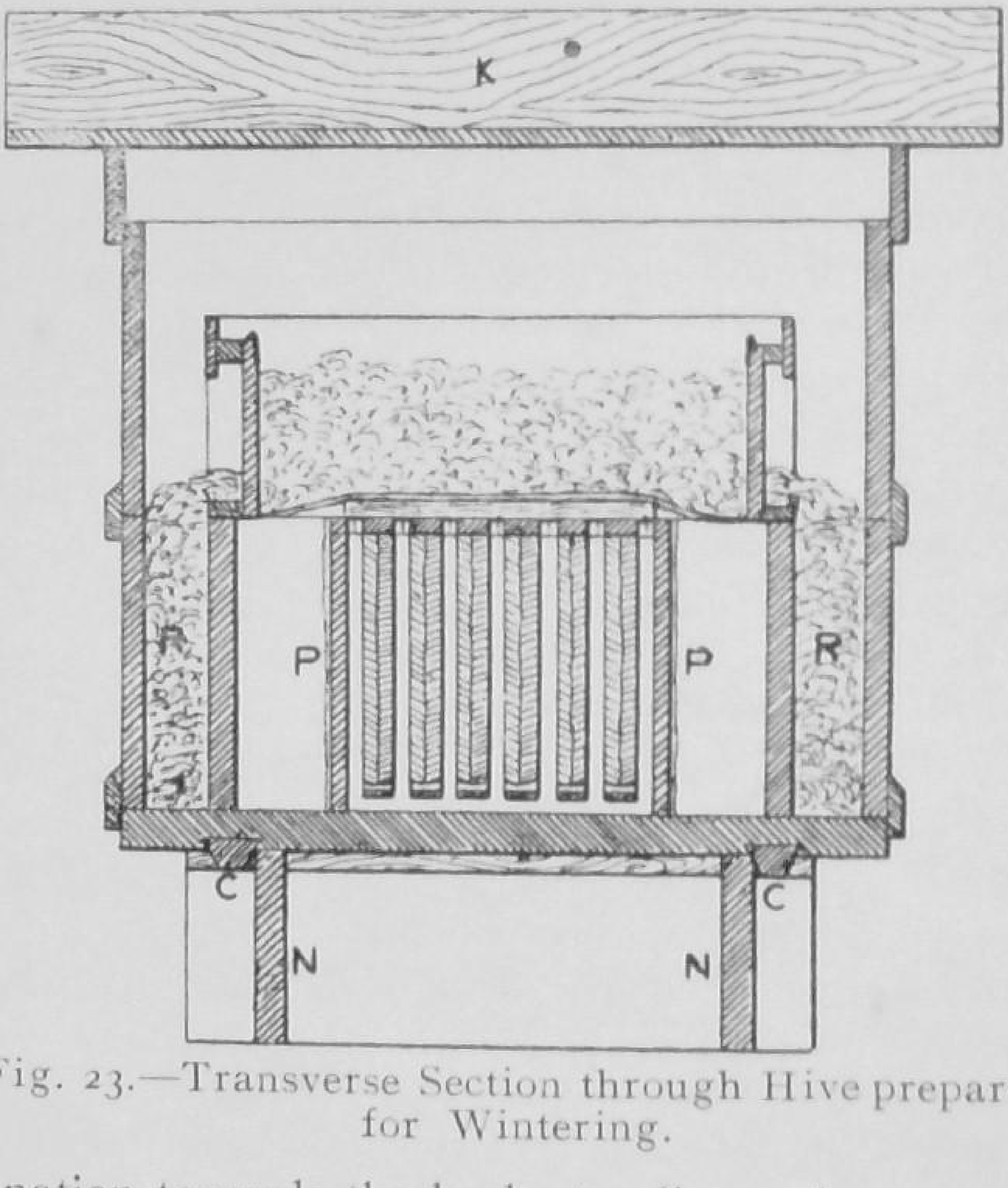


Fig. 23.—Transverse Section through Hive prepared for Wintering.

inclination towards the back, to allow rain to run off. It is covered with thin zinc, or with calico painted to make it waterproof. A piece of wood, L, is nailed on to keep it in position. The alighting-board, M, 15 inches long, slopes to the ground, and is fixed to the stand, N, which is 6 inches high, and consists of two pieces of board, 6 inches wide, kept the right distance

apart by a piece the same width nailed at the back. O is the section-rack in position over the frames. The hive is shown in elevation on title-page.

Fig. 23 is a transverse section of the same hive prepared for winter, the frames being reduced to six, and the space contracted by the division-boards, P P. The outer spaces, R R, are filled with chaff. In wintering, the strip of wood, H, must be put in position, as shown in Fig. 22, to give the requisite space for the chaff and to keep the passage clear. Across the top of the frames is seen one of the strips of wood to allow of a passage for the bees over the combs. On this is placed a piece of unbleached calico, and over all the chaff covers. (See "Wintering," page 190.) In the illustration a shallow-frame super is utilised for this purpose.

The division-boards, P, are made to fit the hive at sides, the projecting lugs at the top (see Fig. 19) enabling them to hang and slide on the metal runners. A $\frac{1}{4}$ inch space at the bottom allows bees to pass back into the hive during the summer months. In winter they are made to fit tight by having strips of cloth tacked round the edges on the outside. This enables us to contract the space without loss of heat.

All the parts being separable, the hive can be easily moved or examined, the floor-board cleaned and exchanged, and the hive turned in any direction on the floor-board. The frames can be brought closer together, if it is desired to restrict the combs to worker-brood only, as shown at B, Fig. 26, page 46, and can be placed farther apart to enable the bees to cluster more thickly in winter by changing the ordinary for the wide "W. B. C." metal ends on all or on alternate frames as desired. This is important, and adds greatly to success in safe wintering. The outer case being in two storeys, there is ample room for supers. It is

also a great protection to the bees when we wish to examine the frames in windy weather. When used

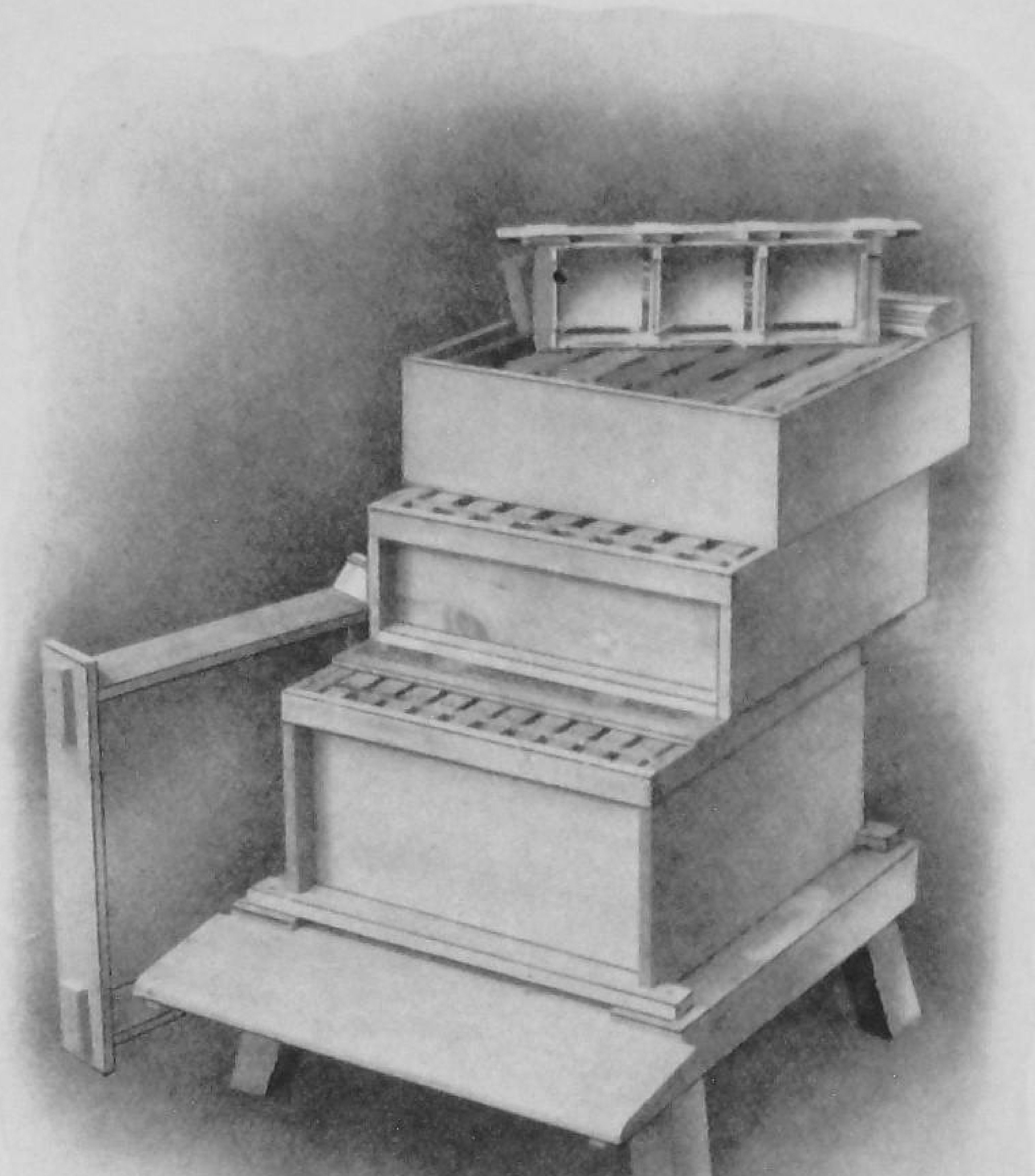


Fig. 24.—The "W.B.C." Hive. Working parts, Outer-cases removed.

for extracting, a third and even a fourth storey can be added, if more room is needed. The low stand, and

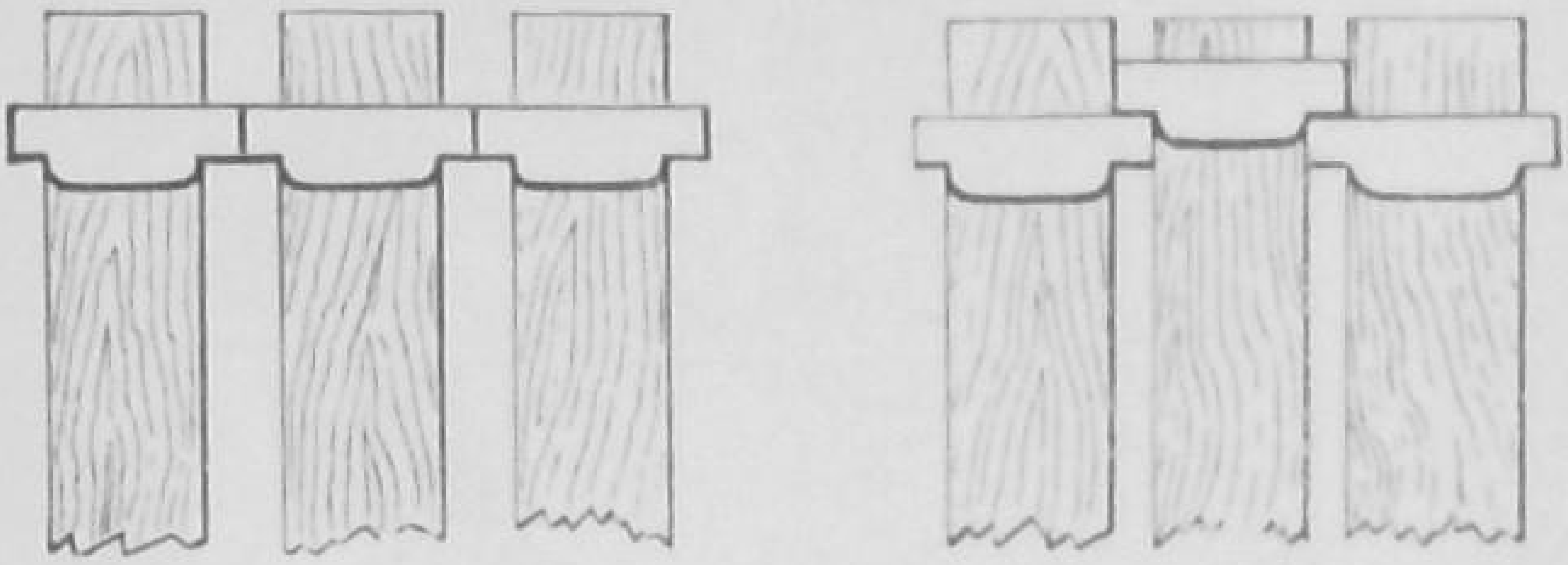
the alighting-board reaching to the ground, save many bees, which would otherwise be lost if blown down by high winds when returning to their hives. All parts exposed to the weather are painted.

Fig. 25.—The "W.B.C." Hive.

Figs. 22 and 23 are drawn to a scale of 1 inch to the foot; those, therefore, wishing to make such a hive can readily do so, the principal dimensions having been already given.

The "W.B.C." Hive.—This hive was introduced

by Mr. W. Broughton Carr as the one used by himself for many years. Fig. 24 shows in detail the working parts of the original form, stripped of the outer cases and roof. The several parts are separable, and consist of (1) a stand on splayed legs, (2) a loose floor-board with wide, sunk entrance and sloping alighting-board nailed on to stout rafters, which slip over the loose stand on three sides, (3) a body-box or brood-chamber holding ten standard frames and division-board, (4) shallow-frame box 6 inches deep with ten frames and dummy (or eight wide frames if preferred), used for extracted honey, (5) a "W.B.C." section-



A B

Fig. 26.—"W.B.C." Metal Ends, spaced respectively—A at $1\frac{9}{20}$in. and B at $1\frac{1}{4}$in. from centre to centre.

rack (Fig. 35, page 57), (6) an "eke" (shown on left in illustration) 3 inches deep, which, when placed below the shallow-frame box, converts the latter, on an emergency, into a temporary brood-chamber. This "eke" can be used below the body-box in winter, or inverted and used above in spring, for tucking in wraps and making all snug and comfortable. Any number of shallow supers can be worked on the storifying principle, and if comb-honey is required, the "W.B.C." section-box is substituted. Excluder-zinc is used between the body-box and extracting supers. The frames are fitted with what are known as Carr's or "W.B.C." metal ends (Fig. 26), made

from a single piece of tin, and are both light and strong. These ends remove a great objection to the use of such appliances, as they enable the bee-keeper to regulate, to a certain extent, the distance of the frames from each other. In Fig. 26, A, they are placed at the usual distance, so that the frames are $1\frac{9}{20}$ inches from centre to centre; but if it is desired to prevent the production of drone-brood, without using full

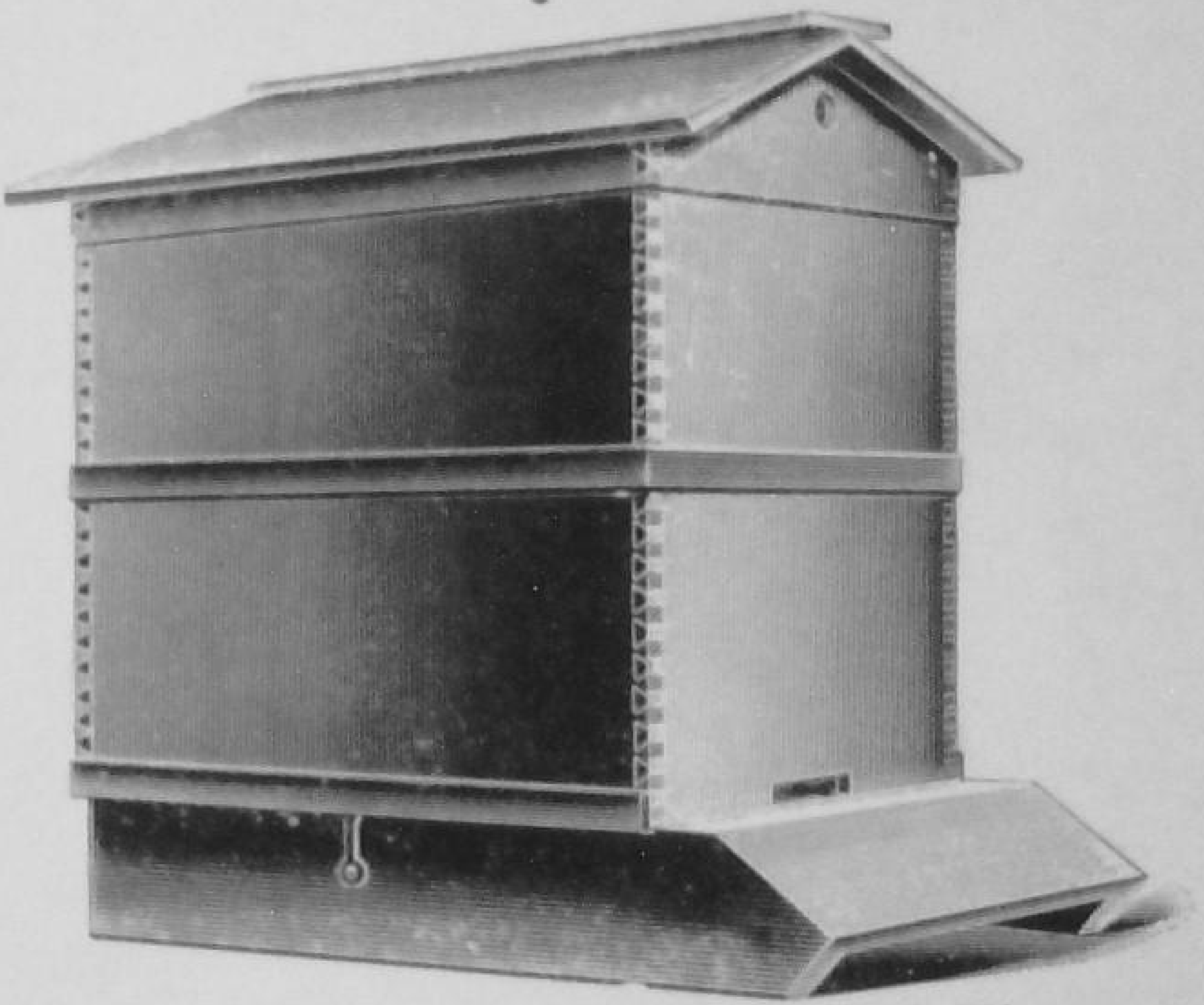


Fig. 27.—Taylor's Dovetailed Hive.

sheets of foundation in frames, the ends of every other frame are slipped back, as in Fig. 26, B, and a distance of $1\frac{1}{4}$ inches from centre to centre may thus be maintained. Great care, however, must be taken to return to the wider spacing when combs are built out. The frames may be spaced wider apart than the ordinary distance by substituting wide metal ends for wintering (see page 191).

Fig. 25 shows the latest form of the "W.B.C."

hive in elevation, made by Messrs. Abbott Bros., Southall, with outer-cases and roof covering the several working parts, as seen on page 45.

Fig. 27 illustrates a useful hive at a moderate price,

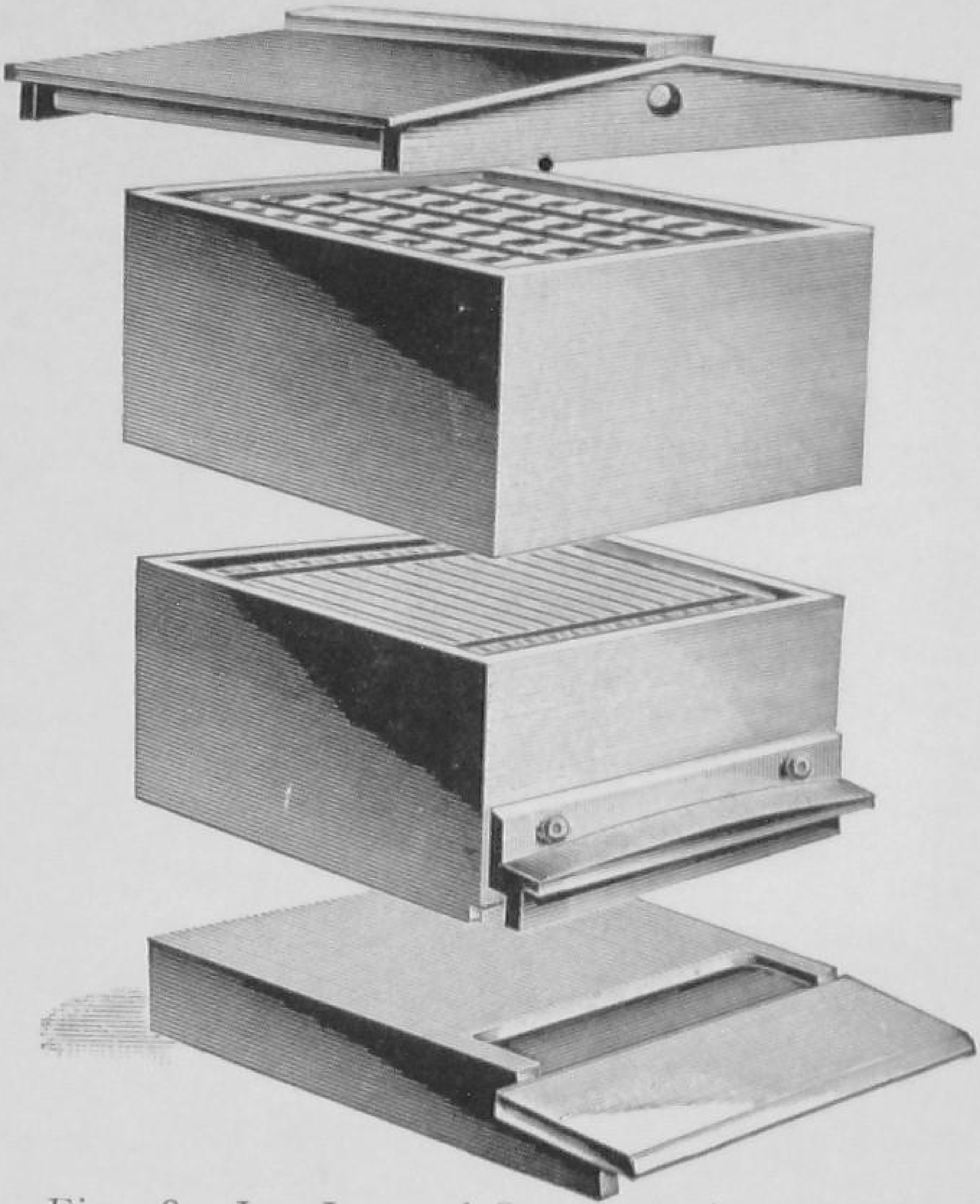


Fig. 28.—Jas. Lee and Son's "Alliance" Hive.

made by Mr. E. H. Taylor. It is dovetailed throughout, and, being simple in form, is very suitable for bee-keepers of limited means. It has a rabbeted floor-board on stout joists, hooks at side to keep the hive body and floor-board firmly together, yet easily

separable when required. The body-box is 9 inches deep, and holds ten Standard frames with "W.B.C." ends; has plinths on three sides; sliding inside walls, which, if desired, may become fixtures by nailing; 9-inch lift, with plinths on all sides; and removable inside walls, which will, when fixed, hold a set of Standard frames, or will cover a super of shallow frames or two racks of sections. The span roof telescopes over the lift, as shown in the illustration.

Fig. 28 represents Messrs. Jas. Lee and Son's "Alliance" hive, suitable for artisans, cottagers, and those who study economy along with efficiency in their bee appliances. The floor-board provides a full-width entrance and sloping flight-board. The body-box is double-walled back and front, ¾-inch single walls at sides; takes ten Standard frames and movable dummy, and has a detachable porch, as shown. The "lift" or super-cover affords ample room for a second body-box, for shallow-frame supers, or for racks of sections. When reversed for winter, the "lift" telescopes over the body-box, thus forming an outer-case, protecting the hive on all sides.

Many other useful hives are on the market, but the limits of space prevent a full description. Excellent and cheap ones are made by Messrs. Rose, Steele, Burgess, Garner, Jones Bros., Burtt, Baldwin, Dixon, Overton, and others, which embody some of the principal features of the hives already described.

It must, however, be borne in mind that, after carefully selecting the most suitable hive for use in an apiary, no departure should be made, seeing that uniformity in hives, which means interchangeability of all parts, tends very largely to secure comfort in working and successful bee-keeping.

IX.—THE CLAUSTRAL HIVE.

This hive, made by Mr. E. H. Taylor, who has the rights for this country, is the invention of the Abbé Gouttefangeas, and has many good features that make it worth a trial. It consists of an ordinary hive (Figs. 29 and 30), to which is attached a claustral porch or ante-chamber, which may be closed and made thoroughly dark, whilst admitting of ventilation, so as to enable the bee-keeper to confine the bees in the hive without causing any excitement amongst them. As will be seen, the ante-chamber in front of the entrance runs the whole width of the hive, and the front can be closed by the alighting-board, which works on a long hinge, arranged so as to keep out the light. When raised, as in Fig. 29, it fits into rabbets in sides and roof, rendering the enclosure perfectly dark. Battens are fixed to the under-side of the alighting-board to avoid warping. To prevent the bees from being suffocated when the chamber is closed, it will be seen two ventilating chimneys are provided. These are from 2 to $2\frac{1}{2}$ feet long and 1 inch in diameter, and pass through the roof and alighting-board. They are perforated with from eight to ten bee-excluding holes

Fig. 29.—Claustral Hive, with Ventilating Chimneys, alighting-board closed.

above this board, and are thus practically impervious to light. At the top there are hoods which keep out the snow, and also assist in obstructing the light. Fig. 29 shows the chamber closed, while Fig. 30 is the same hive with the alighting-board down, and shows the position of the ventilators very clearly. With the lowermost holes in tubes just above the floor and close to the entrance of the hive ventilation is perfect: One of the advantages, and a very important one, is that of being able to confine the bees without detriment in the early spring, when so many are lost by untimely flights. With an apparatus of this sort the inventor has been able to confine bees for five months, and right up to the honey-flow, without detriment, allowing them to take cleansing flights once a month. Owing to the bees being less excited when kept in the dark, the consumption of stores was found to be less.

Other advantages claimed for the system are that in the winter an idea of the condition of the population can be arrived at without opening the hive. If the hood on the chimneys be turned down, and the nose applied at the top of the tube, the smell would indicate whether brood was being reared and in a healthy state, and a tap on the side of the hive would discover whether the bees were in good condition or not. In that way the hive could be satisfactorily diagnosed. Hives can be moved with ease short distances, for they would be closed, and the bees kept in confinement for a short time, or as long as the bee-keeper likes, as it is well known that bees kept closed in this way soon forget their old locality. Then, in making swarms, it is not necessary to take them to a distance, and when the number of bees introduced into a hive is sufficient it can be closed, and there is no danger of the bees going back to their old stand if the hive remains closed for a day or even two days. Colonies are also easily

Claustral hives in Mr. E. Pidduck's Apiary, Alsager, Cheshire.

equalised by placing them near each other, and when sufficient bees have left one hive, closing it and compelling them to enter the other one. This in its turn can be closed for a certain time to allow the bees to forget their locality. It is evident that this plan can be applied in many ways, and permits us to dispense with many manipulations.

In an ordinary hive all know how difficult it is to prevent robbing, and how when it is once commenced it is still more difficult to stop it. With the claustral hive nothing is more easy; the robbers can be caught in the act, imprisoned, and the demoralisation of the apiary prevented. One has merely to close the hive that has been attacked, and after a few minutes open it, when all the robbers, believing night to have come, rush off home to their own hive, where they can be shut up. Or, if it is difficult to find out which is the robbing colony, close all the doors, and after a few minutes open one and watch the bees, and if they are the robbers they will make a turn in the air and fly towards their own hive. This can be opened, and when they are all in, the bees can be imprisoned and all the others released. Then, again, how easy it is to con-

Fig. 30.—Claustral Hive, with alighting-board down.

fine colonies during manipulation, or when feeding is necessary, or when extracting and returning combs for cleansing. In case of bee-pest a colony could be treated to medicated food and isolated, making it possible to deal with it without danger to any of the other colonies in the apiary; and, indeed, anything can almost be done without disturbing the others by simply shutting up the hive.

X.—SURPLUS COMB-HONEY.

No hive can be considered complete unless it has some arrangement for securing pure honey in the comb, and his ability to produce it in quantities and in the most attractive form shows the skill of the bee-keeper. The large supers and glasses once used for

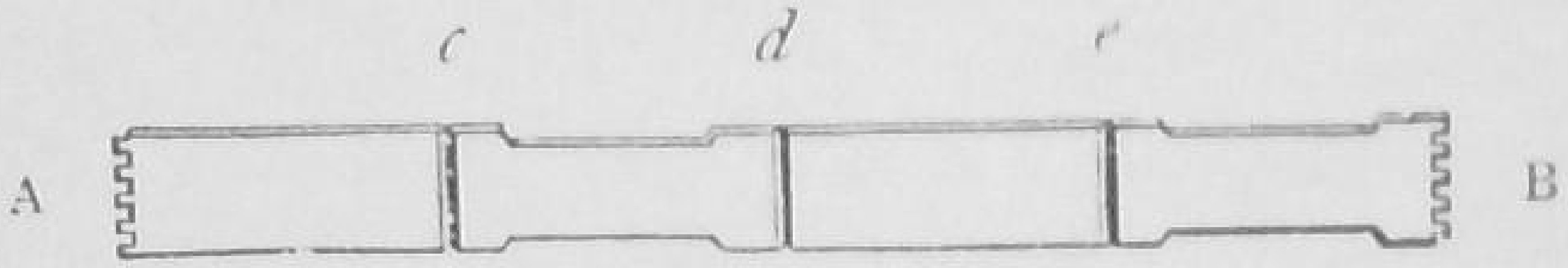


Fig. 31.—One-piece Section.

the purpose of securing surplus honey have given way to those now known as sections. These generally contain 1 lb. of comb-honey, are clean and nice to handle, and can be transported from place to place without

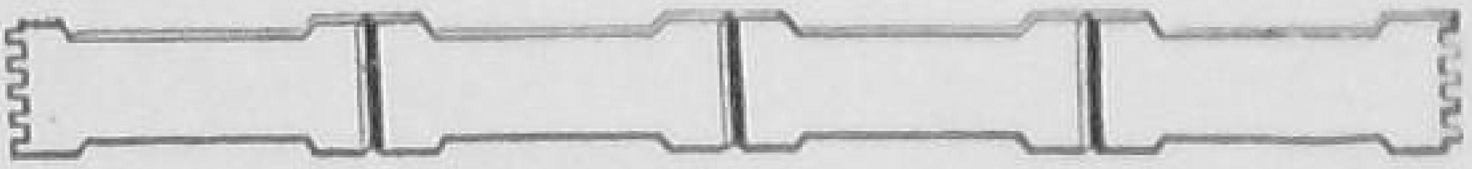


Fig. 32.—Four-way Section.

incurring the same risk of breakage as when the honey-comb is in large boxes. The retailer can also

sell it without cutting the combs, which always causes a mess and a waste of the running honey. For this reason honey in sections will always realise a higher price in the market.

The sections are small boxes (Fig. 33) made generally of white wood $\frac{1}{8}$th of an inch thick, $4\frac{1}{4}$ inches by $4\frac{1}{4}$ inches, and 2 inches wide. The top and bottom are only $1\frac{3}{4}$ inches wide, so that when the sections are put together on the top of a hive there is sufficient room for the bees to pass up into them. Other sizes and shapes of sections have from time to time been introduced, but the one first mentioned is in general use.

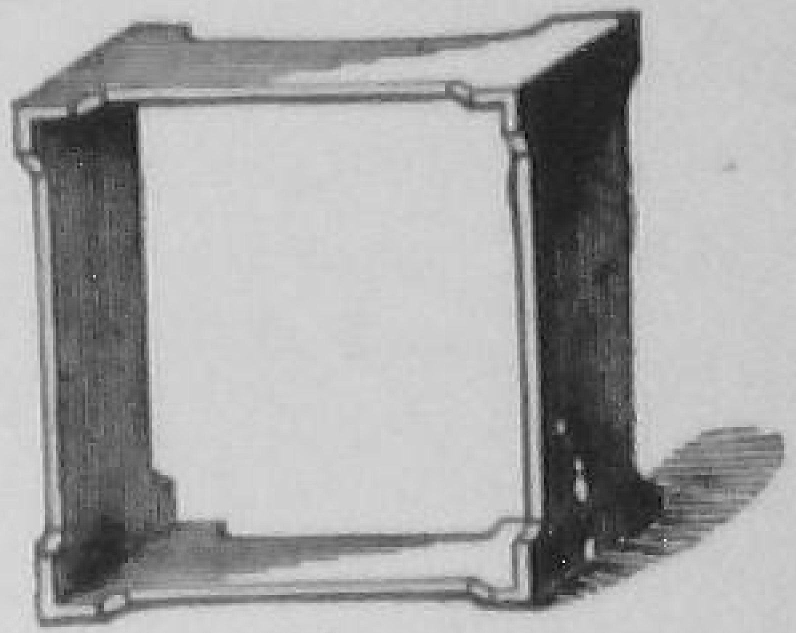


Fig. 33.
Four-way Section.

Sections are generally made all in one piece (Figs. 31 and 32). Each piece of wood to form the section has a mortise-and-tenon arrangement at the ends, A, B, and V-shaped grooves cut nearly through across the wood, as shown at *c*, *d*, *e*. If the strip is folded up so that A and B are made to unite and fit into each other, we have the section made and ready for use. If a little thin glue is brushed into the grooves the sections are much stronger, but the bees will generally glue the joints together with propolis and make them sufficiently firm.

Some use what are called four-way sections (Fig. 33). These are so constructed that bees may pass freely from one section to another placed by its side.

These boxes are furnished with very thin comb-foundation, and are placed together in a rack. For ordinary sections a close-sided rack (Fig. 34) may be used. On the bottom a frame of wood $\frac{3}{8}$ths of an inch thick is fixed in such a way that when the sections are

placed in position there will be room for the bees to run freely between them and the tops of the frames. The separators are strips of tin, wood, or perforated zinc, reaching to within ½ inch of the top and bottom of the sections, and are placed between each row of the little boxes. This ensures the flatness and even thickness of every comb, so that they can be packed or covered with glass without any difficulty. Never use sections without separators, for, although it is sometimes possible to get a few of them just right, the annoyance

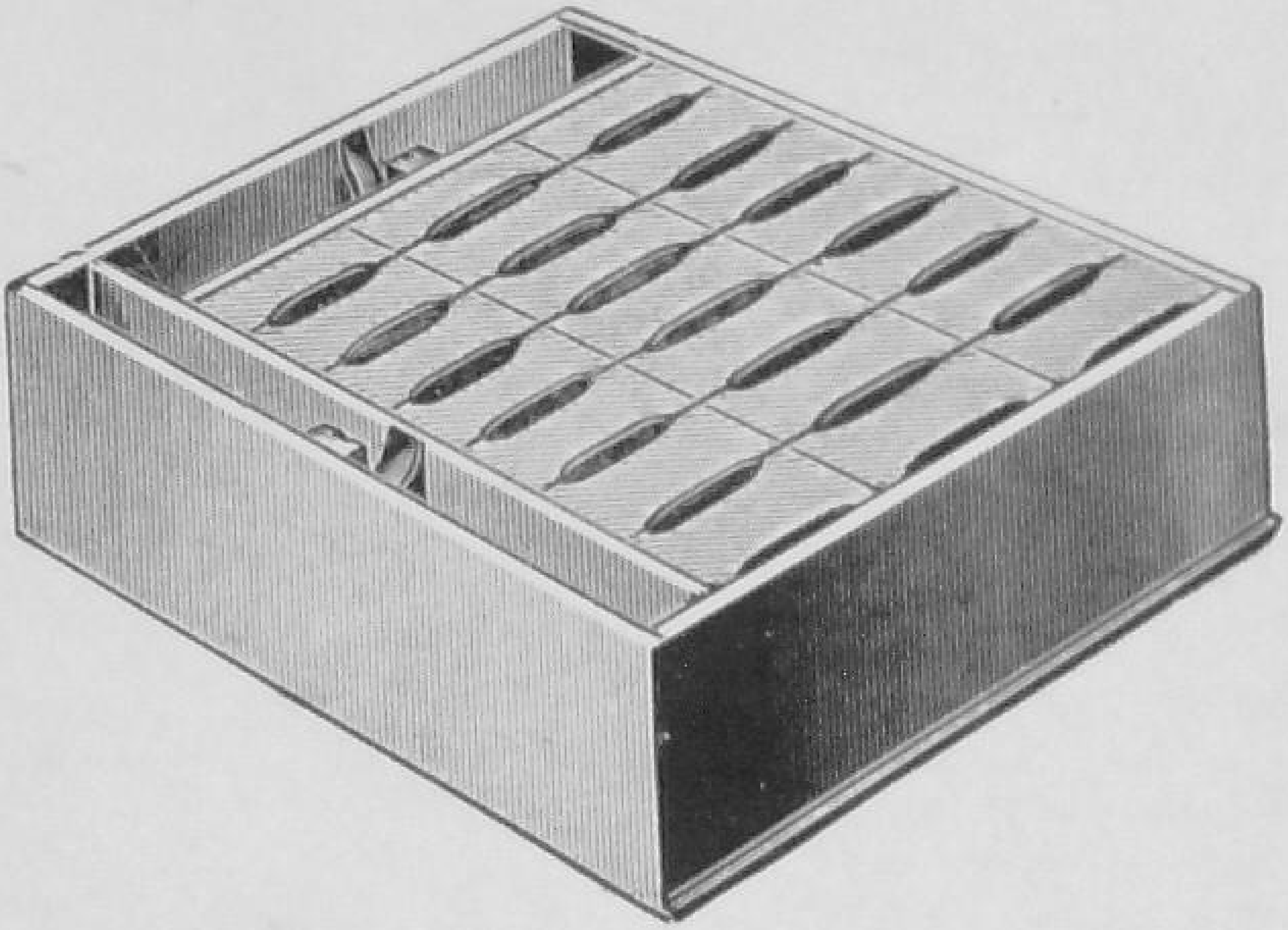


Fig. 34.—Lee's Section-rack.

and trouble of having some of the combs broken before the sections can be separated are very great, and certainly would not occur if separators were used. To keep the sections in position and perfectly true to shape, pressure is exerted by means of springs on two boards, as shown in Fig. 34. The outer case being the same size as top of hive, the escape of bees into the former is entirely prevented.

The "W.B.C." section-rack (Fig. 35), devised by Mr. W. Broughton Carr, contains seven frames the width of section, with passage-ways on top and bottom

bars, and on one side of each is fixed a wooden slotted separator. There is the usual bee-space below the frames, and the follower has a full bee-space on face next to separator, to prevent crushing bees when closing up. There is also a free passage between the sections on all four sides. A wedge cut so as to be capable of easy removal is inserted on the right of each frame, and presses the sections close up together. When ready for removal, this wedge is withdrawn, a

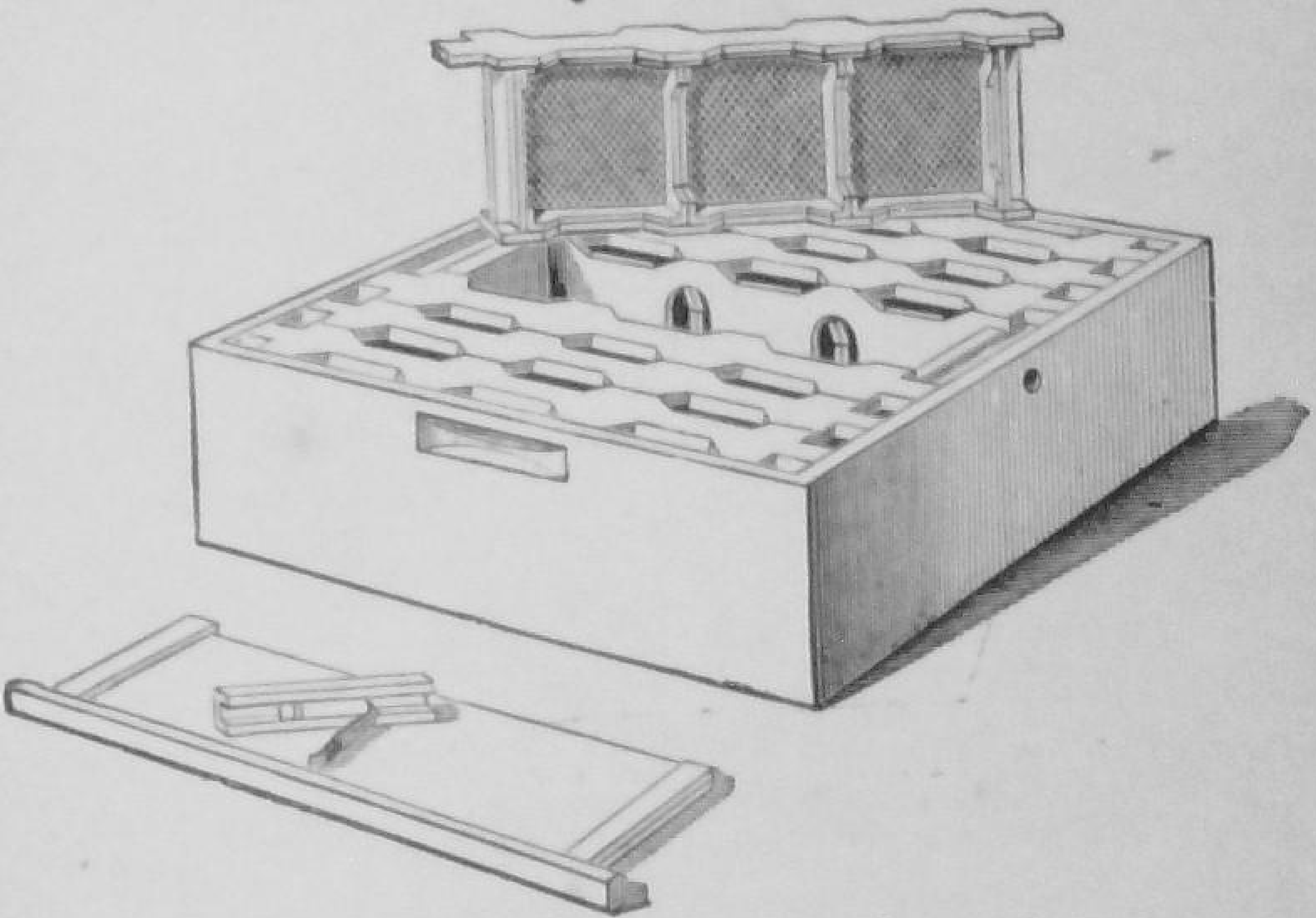


Fig. 35.—"W.B.C." Section-rack.

thin-bladed knife passed round the outside of the sections, and when they are turned face down the frame may be gently lifted up, as they will come out by their own weight. The ends of top bars are reduced for convenience of lifting, and a small circular hole seen on the right is to allow of the escape of bees which might get into the space when the boxes are storified. Working sections in such frames helps to keep them clean and free from propolis.

Usually three storeys of sections are used at one time on the storifying system. When the honey-flow commences a rack of sections, fitted with thin foundation, is placed on the top of the hive, carefully watched, and when the sections are about two-thirds full of comb the rack should be raised, and one with empty sections placed beneath it on the top of the hive. These, too, are in turn raised, and a third placed below. If the honey-flow is good, the top rack will soon be completed, when it should be removed, the remaining two being again raised to give place to another rack below them. This operation should be

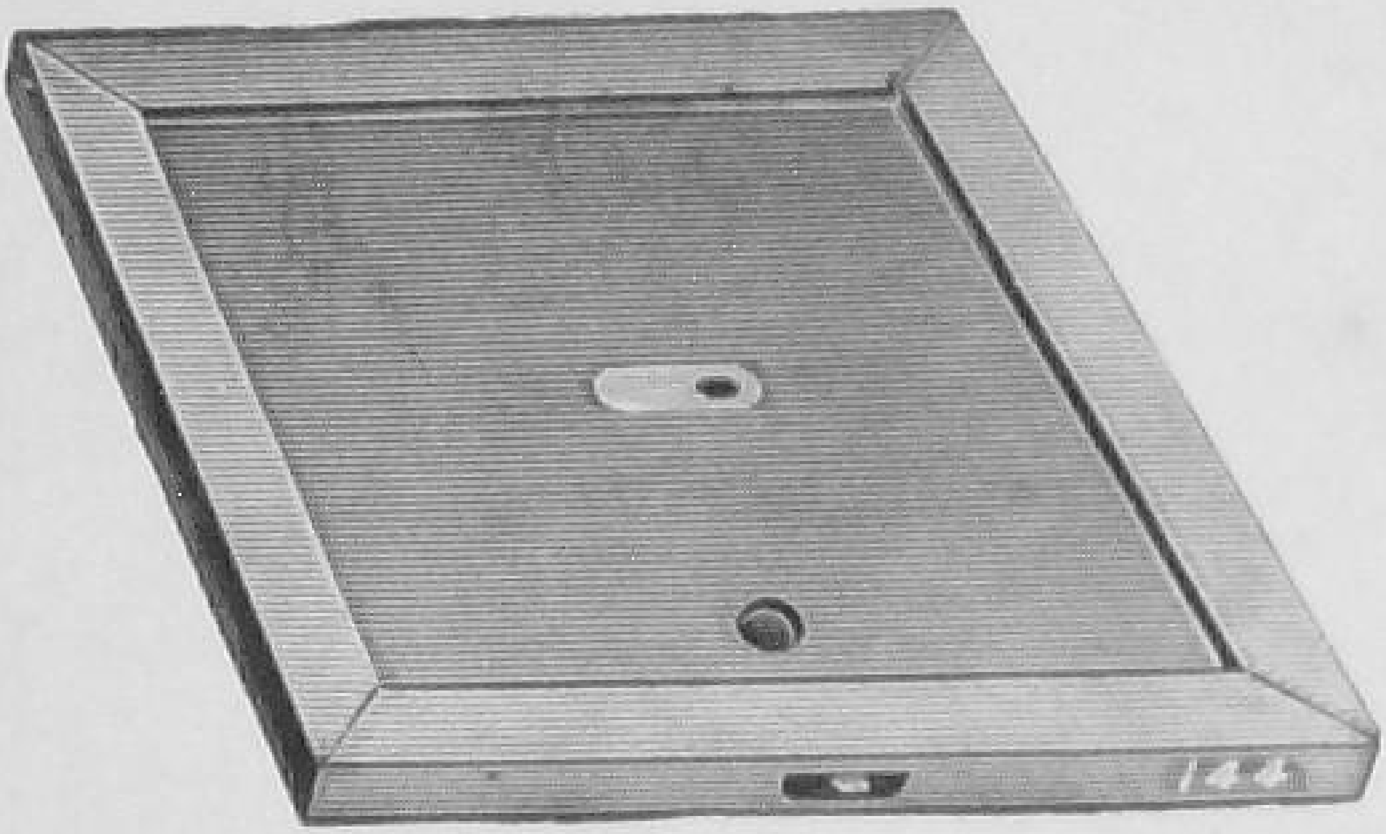


Fig. 36.—Super-clearer.

continued so long as the honey-flow lasts, but as soon as this shows signs of declining no more sections should be given, but the bees must be allowed to complete those already on the hive. When the sections in the top rack are sealed over this should be taken off (see "Subduing Bees," page 97), for if left on too long the appearance of the comb will be spoilt.

The most convenient way of getting bees out of sections is by the use of a super-clearer (Fig. 36) with "Porter" Bee-Escape, of which an enlarged illustration is shown on page 164. The rack of sections is raised and placed on the board with the circular open-

ing of the escape uppermost, then the super is replaced with "clearer" below it on the hive. After a few hours the rack, generally clear of bees, may be removed. It is advisable to put on the clearer at night and remove the sections in the morning.

After removal, sections should be placed in a storing-crate (Fig. 37); this may be made to hold two or four dozen, and, being glazed on both sides, will protect them from dust and robbers. Or the sections may be sorted, cleaned, and placed into the travelling-crate (Fig. 69) as removed from the racks. All unfinished sections can be placed together in a rack, which, when filled, may be put on the top of others for completion.

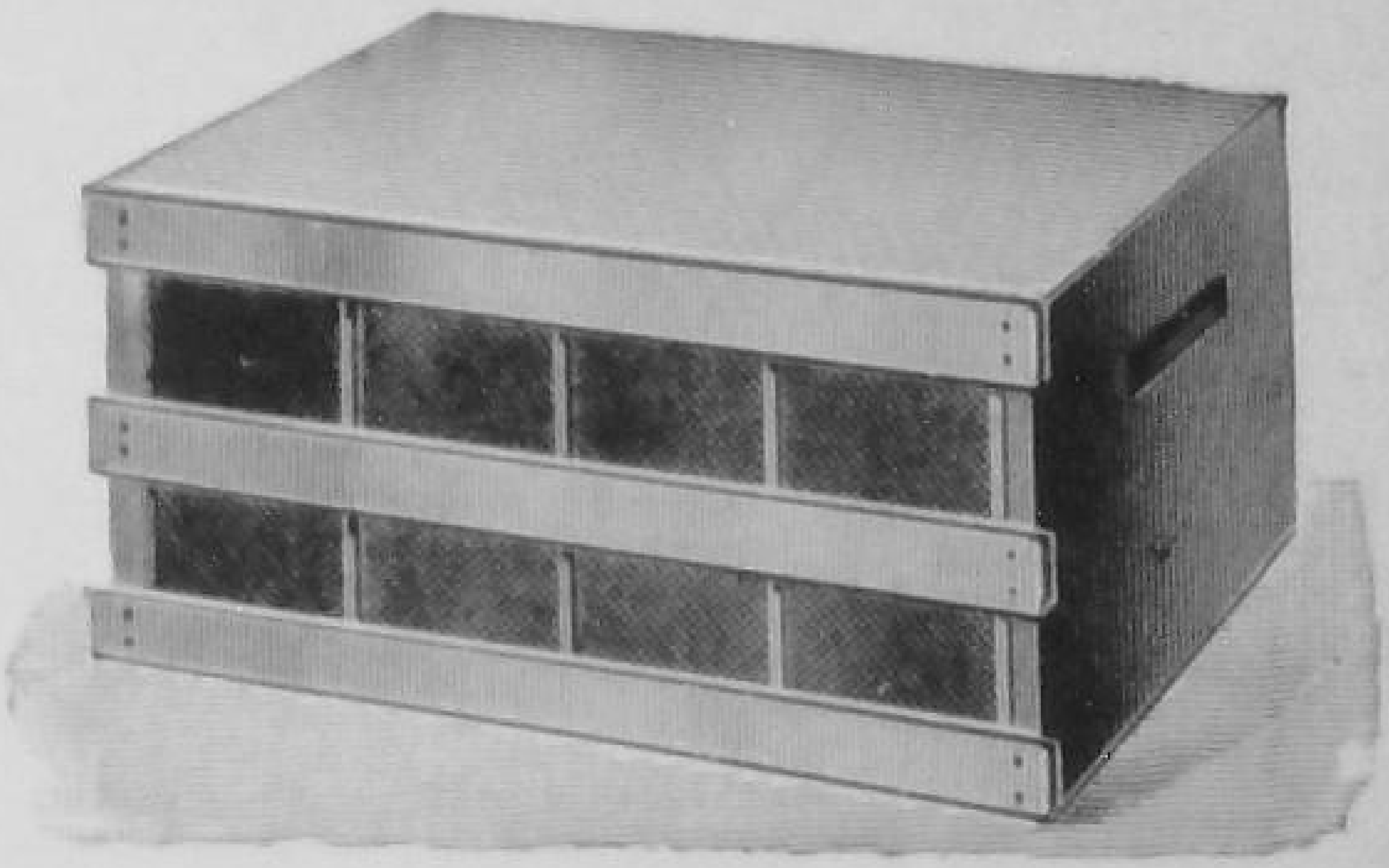


Fig. 37.—Storing-crate.

Bees, being at times unwilling to enter sections, especially when excluder-zinc is used, may be induced to do so by removing some of the frames from the hive, which contain honey only, and contracting the brood-nest by division-boards to eight frames. Being cramped for room below, they run up into the sections, more particularly if these are already provided with a few partially-built combs.

In order to overcome the difficulty, some experienced bee-keepers dispense with excluder-zinc. They contend —rightly enough, no doubt—that allowing a free passage-way reduces the objection of the bees to take possession of sections, and, when the judgment of the

bee-keeper can be relied on, it is fairly safe to follow the plan. But for the less experienced it will be found more satisfactory in the long run, and less productive of disappointment, to make sure that their sections will not be spoiled by being filled with brood, and this desideratum can only be safely ensured by the use of excluder-zinc (page 63). It may be said that once the bees get accustomed to the zinc they will work as freely through it as without.

It will also assist in getting bees to pass through the perforations if the zinc is laid close on the top bars, allowing no bee-space between, as is sometimes recommended, as improving free passage-way.

To remove sections rapidly from racks, get three blocks of wood 2 inches square and just the length of a row of sections. Place these blocks on a table the right distance apart, so that when the rack of sections is laid upon them the blocks will go between the bars which support the sections. Then press down the sides of the rack, and the sections, being forced upward, will stand above the top, and can be easily removed. This is preferable to forcing them quite out, as the sections are less liable to be damaged by slipping off. Considerable care is needed when removing comb-honey in sections in order to avoid spoiling them by thumb-marks in the comb-surface. This is especially the case when using the "W.B.C." rack (page 57). If the hanging-frame is not well made —as is often the case—the sections fit too tight for easy removal. They should come out quite easily by their own weight when the frame is laid face down.

Sections when being filled should be well protected with some warm covering, otherwise they, being so thin and cold, are likely to be deserted by the bees' leaving them for the warmth of the hive below during a cold night.

XI.—STORIFYING FOR SURPLUS.

When extracted honey is mainly worked for, the following method may be adopted :—Select two strong stocks, and from one of them remove all combs con-

Fig. 38.—Removing Surplus from Storified Hive. (Using the Super-clearer.)

taining brood, shaking and brushing the bees back into the hive. Place these combs into an empty hive, and fill the hive from which they were taken with empty combs or comb-foundation. The hive contain-

ing the brood-combs is now placed above the other stock, forming a second storey. Thus, a double set of combs is given, the hive full of comb is soon full of bees by the hatching above and below; and this immense population will quickly fill with honey the emptied combs of the upper storey, which, as fast as filled, may be emptied by the extractor, and returned to be refilled. By this means strong colonies have the swarming propensities checked, are kept at work, and a very large harvest of honey is obtained.

Another plan, which with me has yielded very excellent results, is to work three or even four Standard-frame hives one upon the top of the other. As soon as the stock-hive is well filled with bees and before they swarm, place a second hive, filled with empty combs, upon it. These are at once utilised by the workers in storing honey, and by the queen in depositing eggs. When these two storeys are crowded, add a third, also filled with empty combs, and then a fourth. The two lower storeys can be kept for breeding purposes, and the two upper ones for extracting.

The frames in the two lower storeys should be placed $1\frac{1}{4}$ inches from centre to centre, which will prevent the rearing of drone-brood, and those in the upper storeys may be placed $1\frac{1}{2}$ to $1\frac{3}{4}$ inches from centre to centre. These distances can be regulated by using the ordinary and wide metal ends to frames. The narrow spacing is obtained by placing the "ends" as shown at B (Fig. 26), and the wider by using alternately a wide and narrow end. To prevent the queen from going up into the honey-chamber, a piece of enamel-cloth may be placed over the frames, leaving a $1\frac{1}{2}$-inch space at the sides for the bees to go up into the honey-chambers; or a sheet of excluder-zinc may be used. This has long perforations, just large enough to allow the workers to pass through freely, while it pre-

vents the queen from doing so. It is important to have it just right, for a small variation in the size of opening defeats its object. Experience has also shown that when whole sheets of zinc are used the spacing between the slots should not be too narrow, as it not only weakens the zinc, but, as this metal is very liable to buckle, the openings are frequently so enlarged as to allow queens to pass, rendering this sort of excluder useless for the purpose for which it was intended. The best excluder-zinc is that known as the "B.B.J." pattern (Fig. 39). It has a spacing of $\frac{3}{16}$ths of an inch between the perforations, and is perforated in such a way that it can be cut into 16 inch squares with a plain margin all round, just covering a hive of ten Standard frames. It is placed on the frames with the slots running at right angles to them.

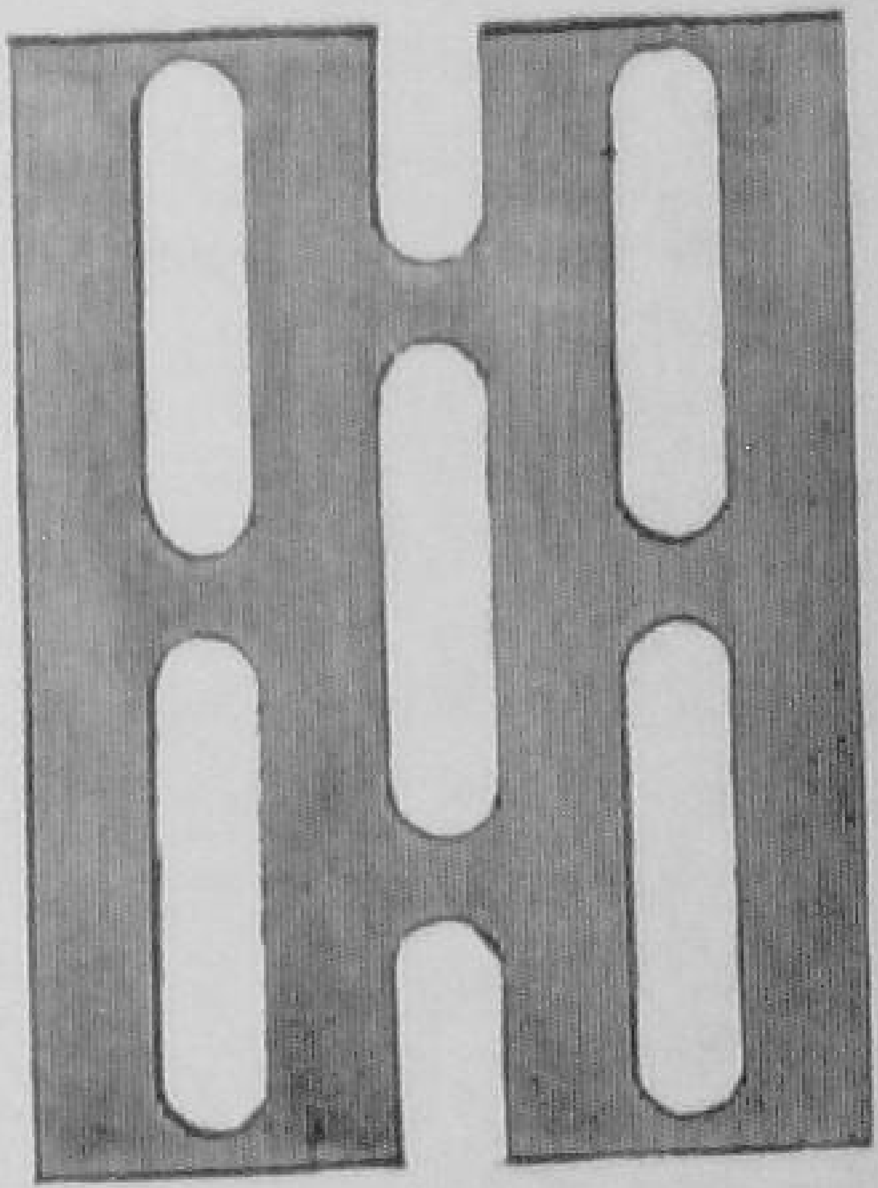


Fig. 39.—The "B.B.J." Excluder-zinc.

The combs will be ready for extracting first at the top, and when they are done the hive containing the extracted combs is made to take the place of the one below it and this one is put on the top, and as soon as the combs are ready they are extracted. This hive then takes the place of the one below it, which is again brought to the top, and extracting goes on so long as the bees collect any honey. The hives are then removed, one after the other, as the bees decrease in numbers, until only the stock-hive remains. Outer cases are put on to protect the hives from the weather,

and as the populations are enormous the fronts have to be raised, by means of wedges about an inch high, to give the bees access on three sides. The outer casing is also raised to allow a free circulation of air, and the separate cases placed as in Fig. 40, so that there is an outlet for the air between them. Colonies thus treated are effectually prevented from swarming and yield a very large quantity of honey.

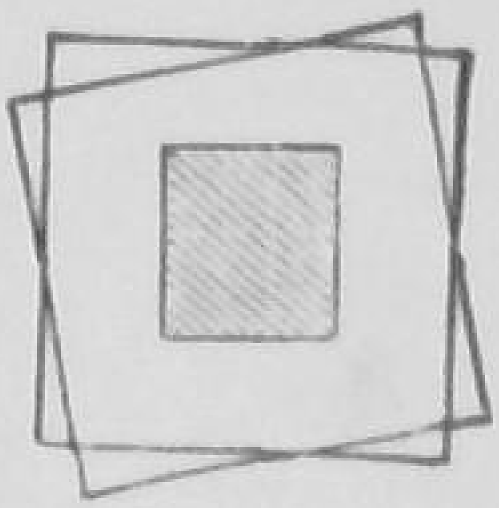


Fig. 40.

Supers fitted with shallow frames are now largely used for this purpose—being preferred by many bee-keepers to the Standard frames, as the enlargement of the hive is more gradual.

The supers shown in section in Fig. 41 are of the same size as the hive, but only 6 inches deep, the

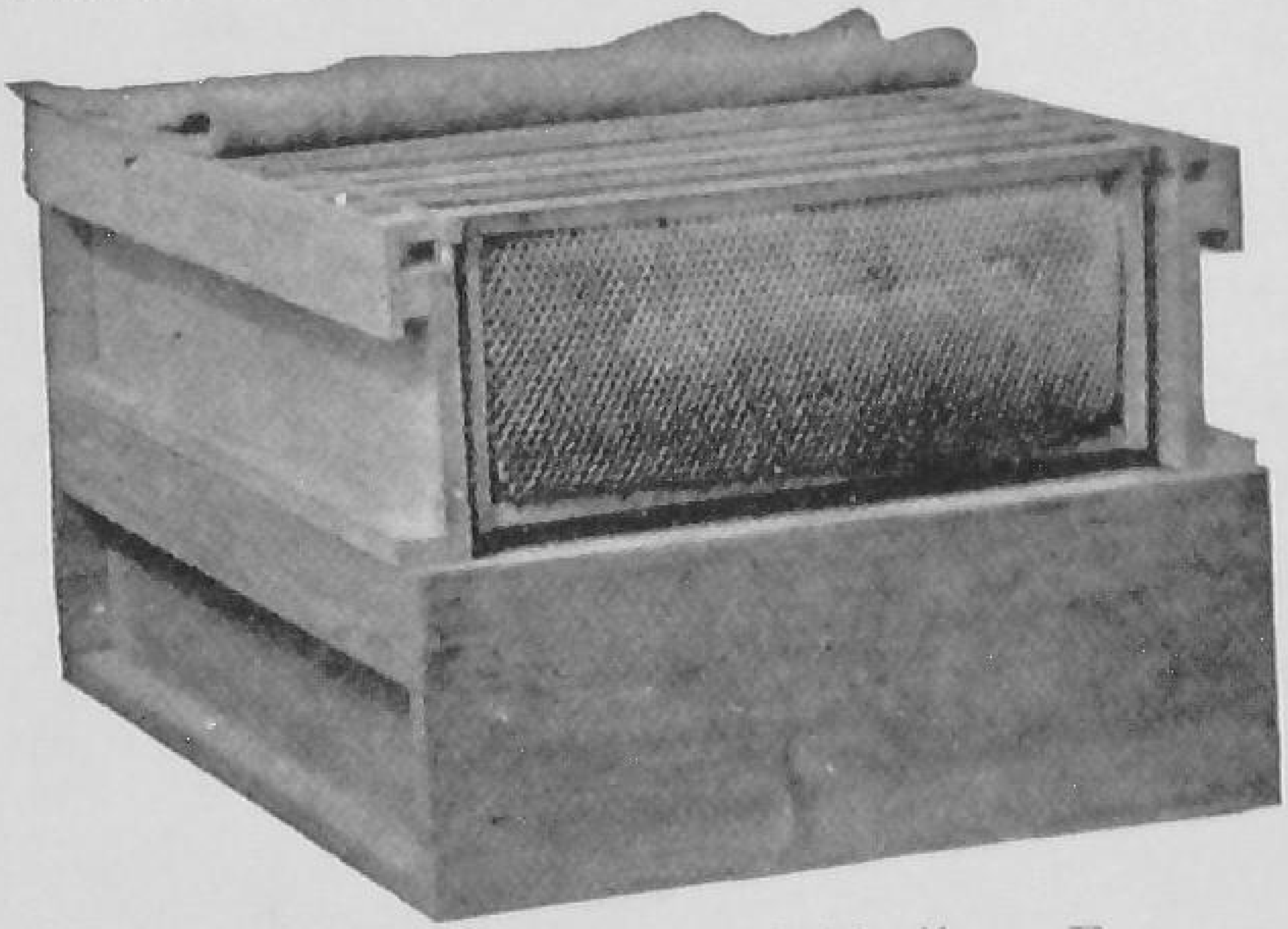


Fig. 41.—Surplus-boxes of Shallow Frames.

frames being $5\frac{1}{2}$ inches deep. These are fitted with sheets of comb-foundation, and two or more storeys are worked in the same way as that described for sections on page 58. It is necessary to have excluder-zinc placed between the hive and these supers to pre-

vent the queen from going up into them. In removing, place a super-clearer (Fig. 36) between the same, as recommended for removing sections. When the frames are all extracted the super is replaced on the clearer, and if the slide introduced by Mr. Meadows is drawn aside at night the bees have access to the

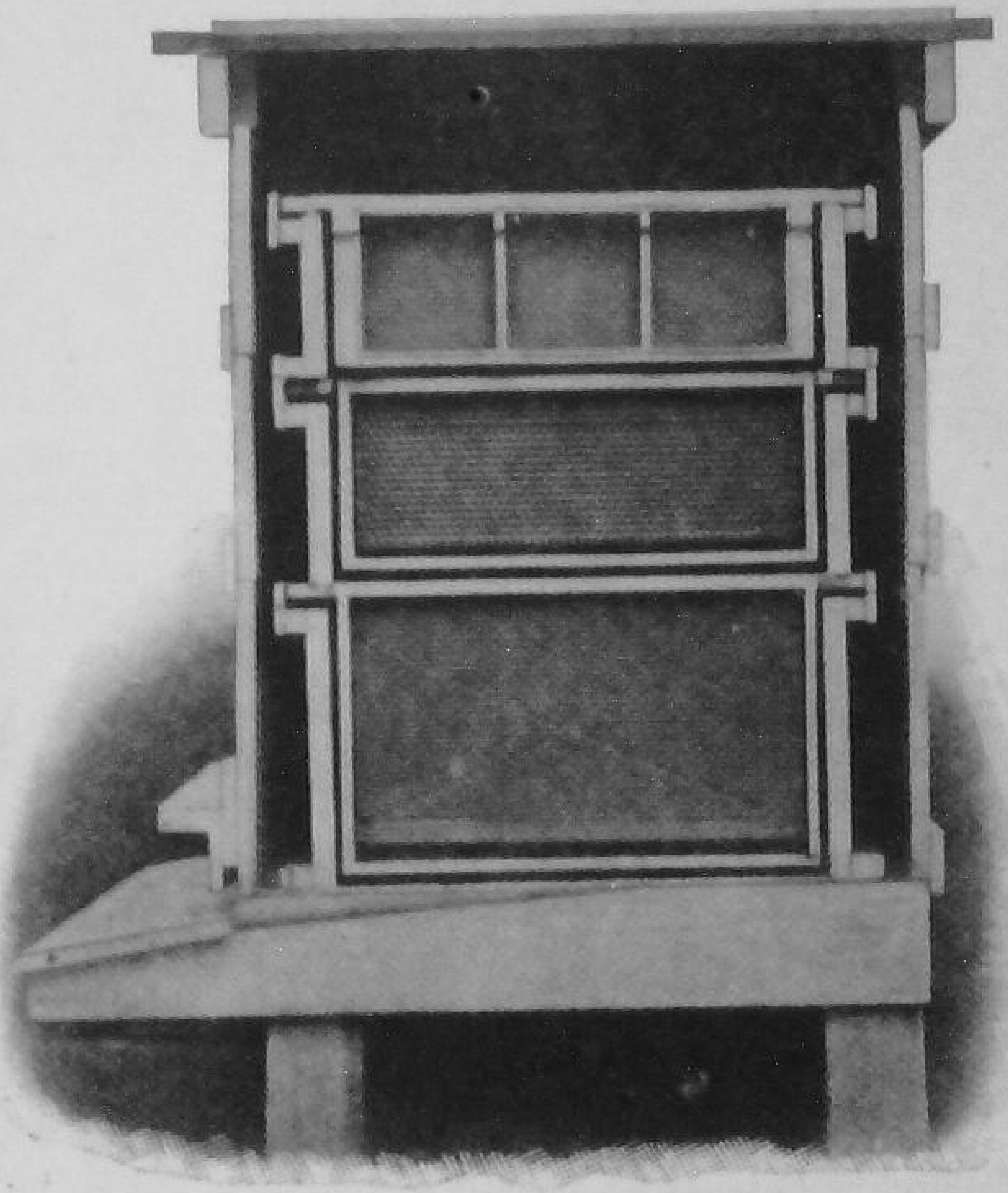


Fig. 42.—Section of "W.B.C." Hive. Storified.

super to clean up the honey-combs, and in the morning the slide can be replaced, when the bees will find their way into the hive through the escape.

The best results are obtained by giving empty combs, and the bee-keeper should always have a large

stock of these on hand ready for immediate use. Those desiring to obtain a few sections, as well as extracted honey, can adopt the plan shown in Fig. 42 on preceding page, which explains itself.

XII.—COMB-FOUNDATION.

A hive is only a movable-comb hive so long as all the combs are built straight and evenly within the frames, so that these can be removed from one part of the hive to another with a certainty of their fitting, and also secure complete interchangeability throughout the apiary.

If the bees are put into a movable-comb hive and left to themselves, they will, as stated on page 24, probably build their combs across the hive or in any direction but that in which the bee-keeper desires them. If, however, the under-side of the top bar of the frame is provided with a strip or "starter" of comb-foundation, they at once accept this as a guide to work out their combs in a perpendicular line from the starters given them.

Very great improvements have been made in comb-foundation in the last few years; it is quite a different thing now from what it was when we began using it over forty years ago. Then it was used only in narrow strips, and made by simply pressing a sheet of wax between two metal plates. These sheets contained only the impression of the bases of the cells; but the comb-foundation, which is now made between rollers, has not only the bases of the cells, but also, as represented by the white lines in Figs. 43 and 44, sufficient wax in the projecting walls to completely lengthen out

the cells, so that the bees have only to provide the wax for the coverings.

For brood-frames a much heavier foundation is used than for sections, the latter kind being very thin and transparent, averaging about 14 square feet to the pound.

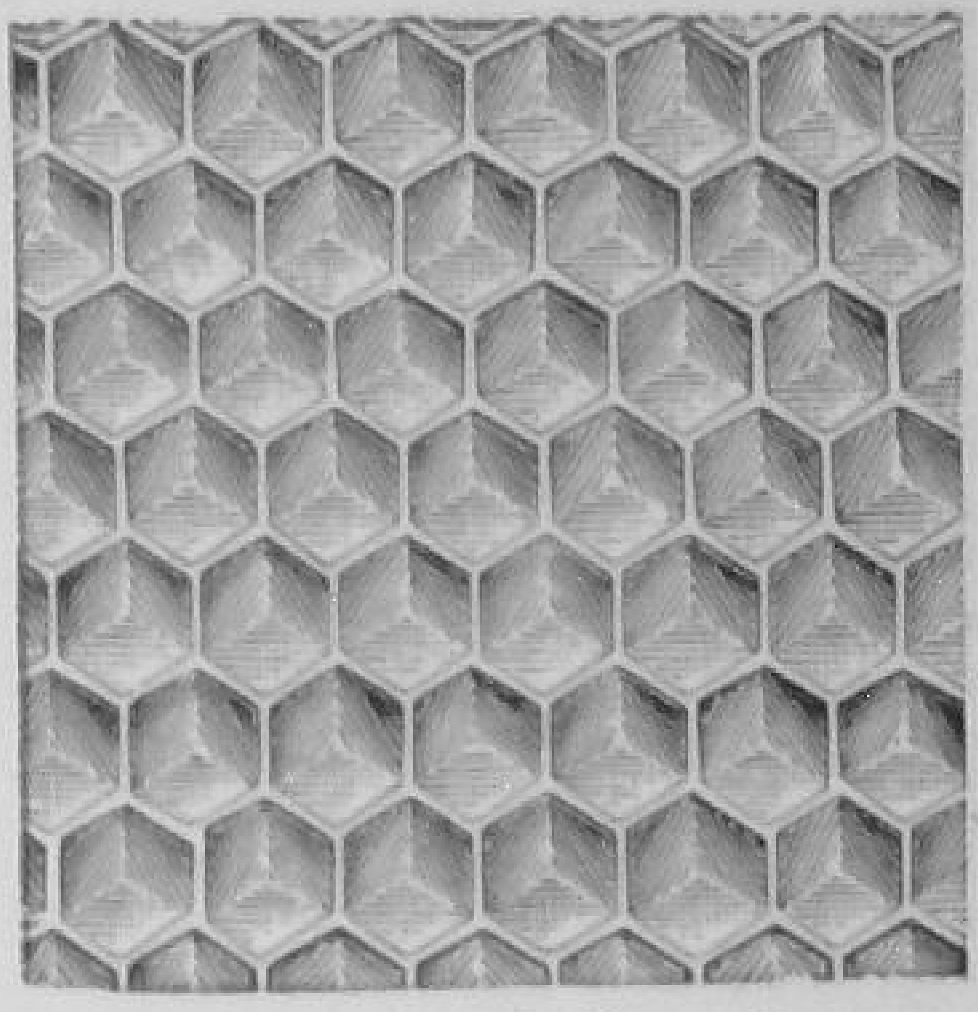


Fig. 43.—Comb-foundation, hung right way up.

Care should be taken to get foundation made from pure beeswax. Some of that sold is adulterated, and bees will often refuse to work upon it when thus made, and valuable time is lost at the most critical part of the honey season. The bad effect of using such foundation is seen in Fig. 45, page 68.

It is also necessary, when fixing foundation, to know that there is a right and a wrong way up, as shown in Figs. 43 and 44. The reason for this precaution will be obvious if we take into account the construction of a cell, and the sustaining power of the side-walls.

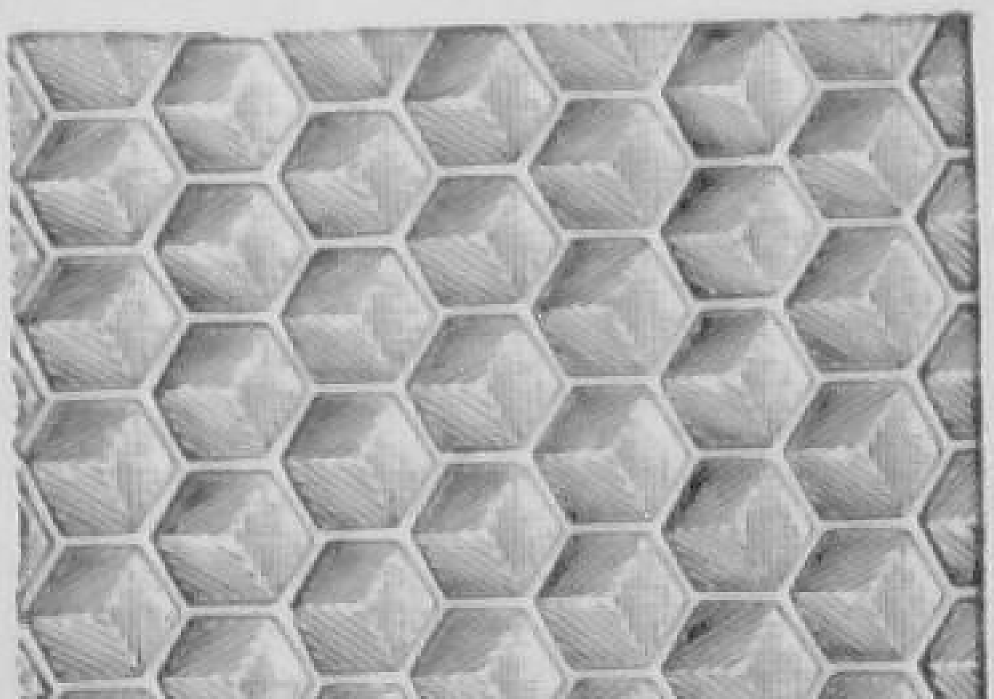


Fig. 44.—Comb foundation, wrong way up.

The greatest advance by far, however, in the production of foundation during the past few years is the invention, by Mr. E. B. Weed, of a method of sheeting wax which has practically superseded all others. By means of the "new process," as it is

termed, a tougher and more transparent article is obtained, in long, belt-like sheets, by passing through rollers exercising a pressure of several hundreds of pounds to the square inch; and when these sheets are put through the milling or embossing process, the result is a foundation with the thinnest possible midrib and higher side-walls than by the former methods of production.

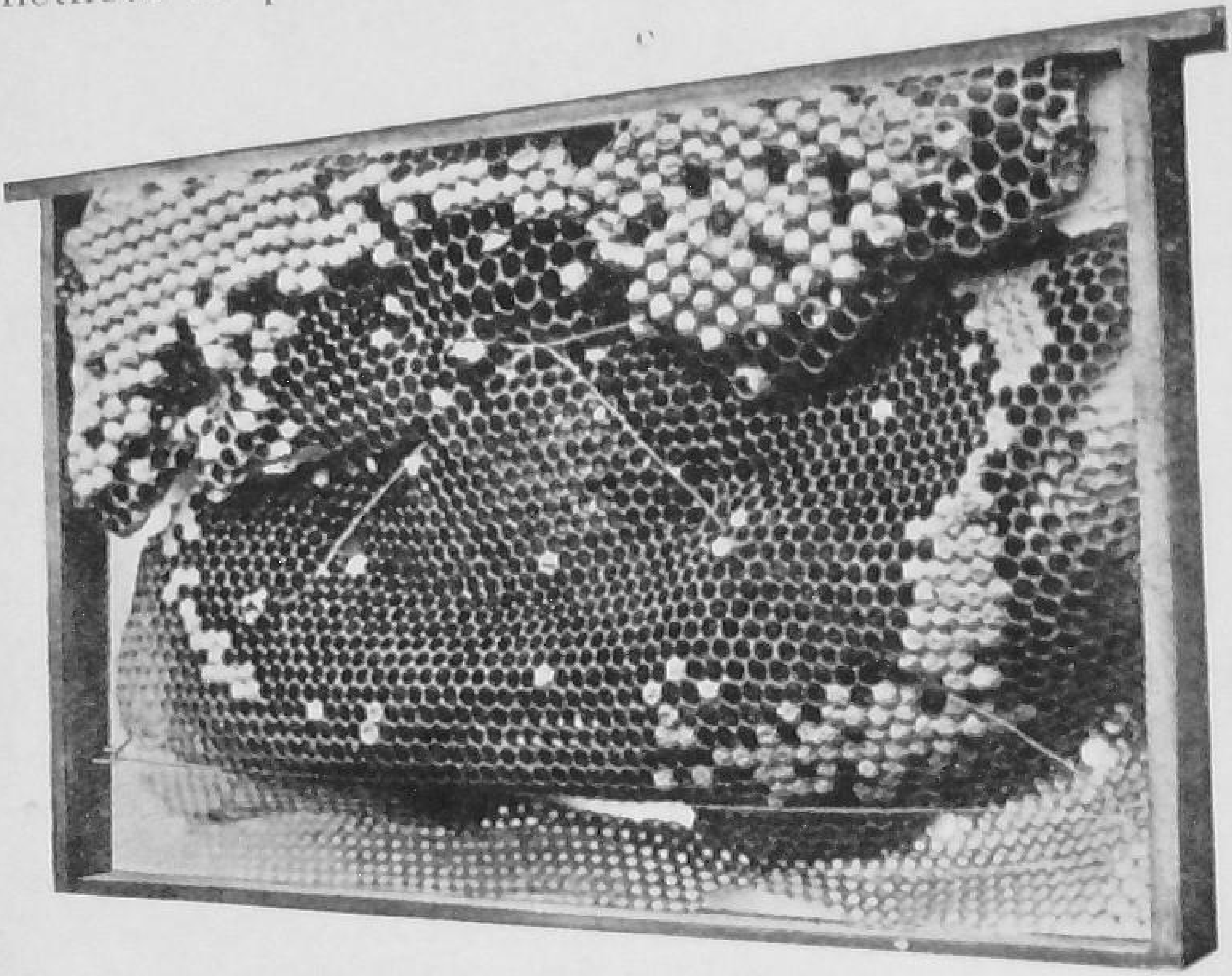


Fig. 45.—Comb-foundation made from Adulterated Wax. Breakdown from Wired Frame.

The A. I. Root Co. are sole makers of the "Weed" foundation machinery, and themselves manufacture the product largely for export, but the exclusive right to manufacture "Weed" foundation in this country, along with the necessary machinery from Messrs. Root, is now the property of Messrs. James Lee and Son. It is termed "British Weed" foundation, in

order to distinguish it from the American product. See illustration of "Weed" machine on next page.

Sheets of foundation for standard frames are cut 13¼ inches long and 7½ inches wide, or, if to be inserted in a saw-cut, 7¾ inches, so that when the foundation is fixed to t e top-bar it will allow half an inch at the bottom in the event of its stretching; but if the frames are wired, the foundation may fill them their full depth.

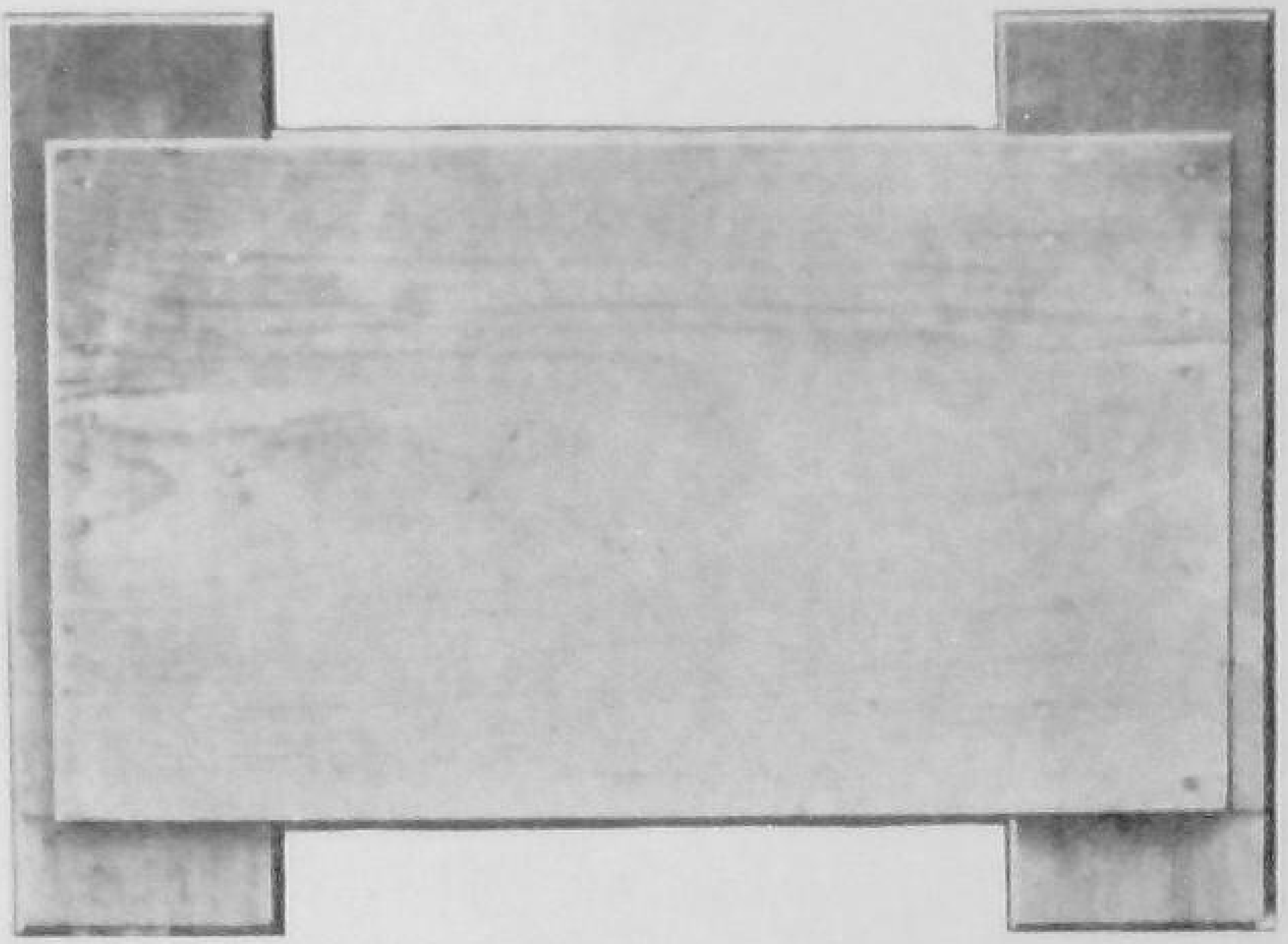
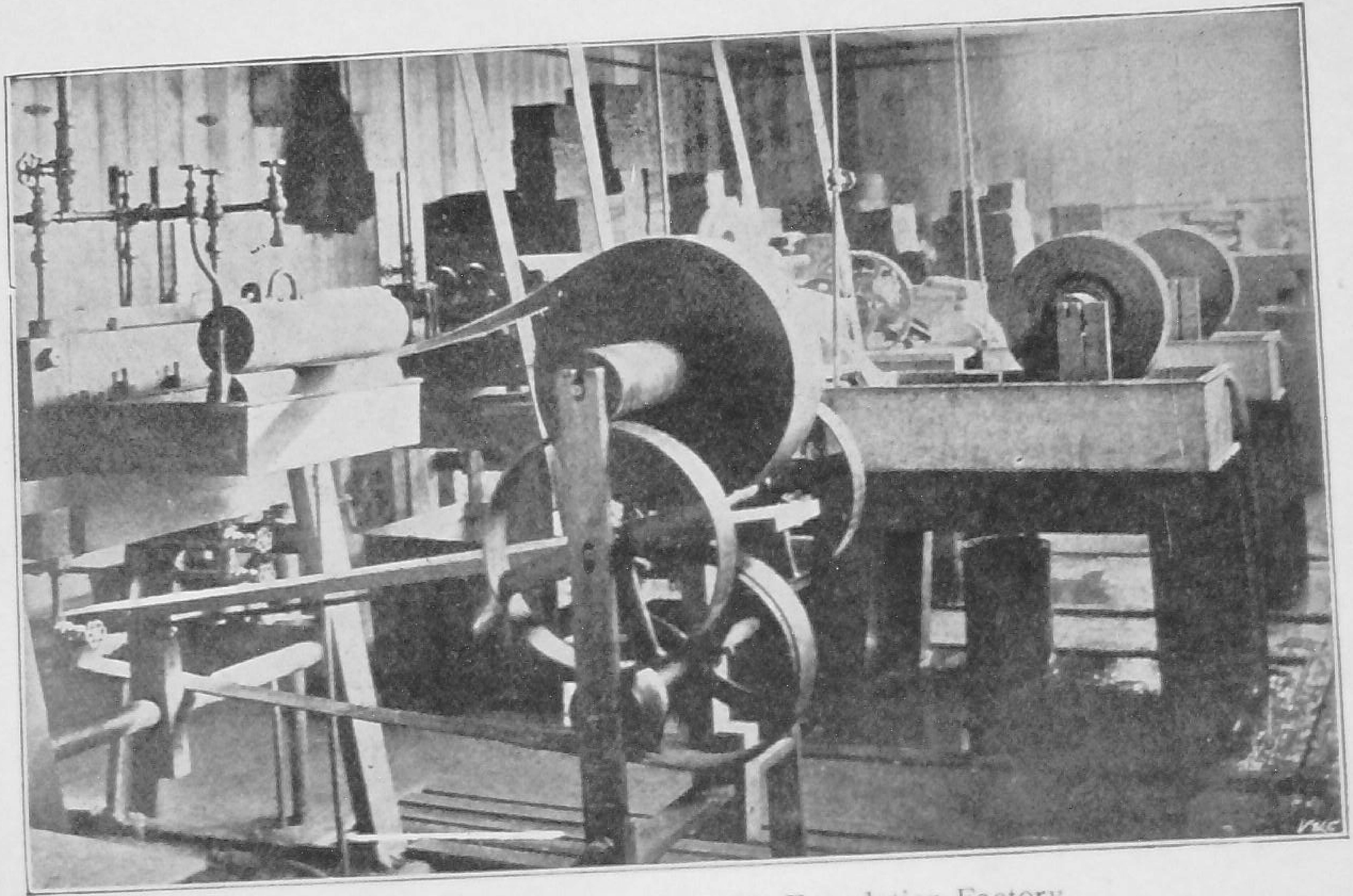


Fig. 46.—Board for Wiring Foundation.
(*In wiring Standard Frames.*)

Ordinary foundation is made 7 sheets to the pound for standard frames, but if "Weed" foundation is used, 8 sheets to the pound is equally strong, and with wired frames what is called "thin brood," 9 to 10 sheets to the pound, may be used with perfect safety.

There are different methods of fixing foundation in frames; if whole sheets are used, any of the following plans are recommended: Procure a piece of wood



Machine-room, "British Weed" Foundation Factory.

$\frac{3}{8}$ths of an inch thick, and cut it to fit into the frame. On the back nail two strips of wood projecting an inch beyond each side of the board (see Fig. 46). On the under side fix a board $\frac{1}{2}$ inch thick and the size of a shallow frame. Two narrower strips, as shown in Fig. 47, will keep the frame in position. A block made in this way answers for the standard as well as shallow frame.

Lay the frames on the projections, place the foundation on the board, allowing its upper edge to touch

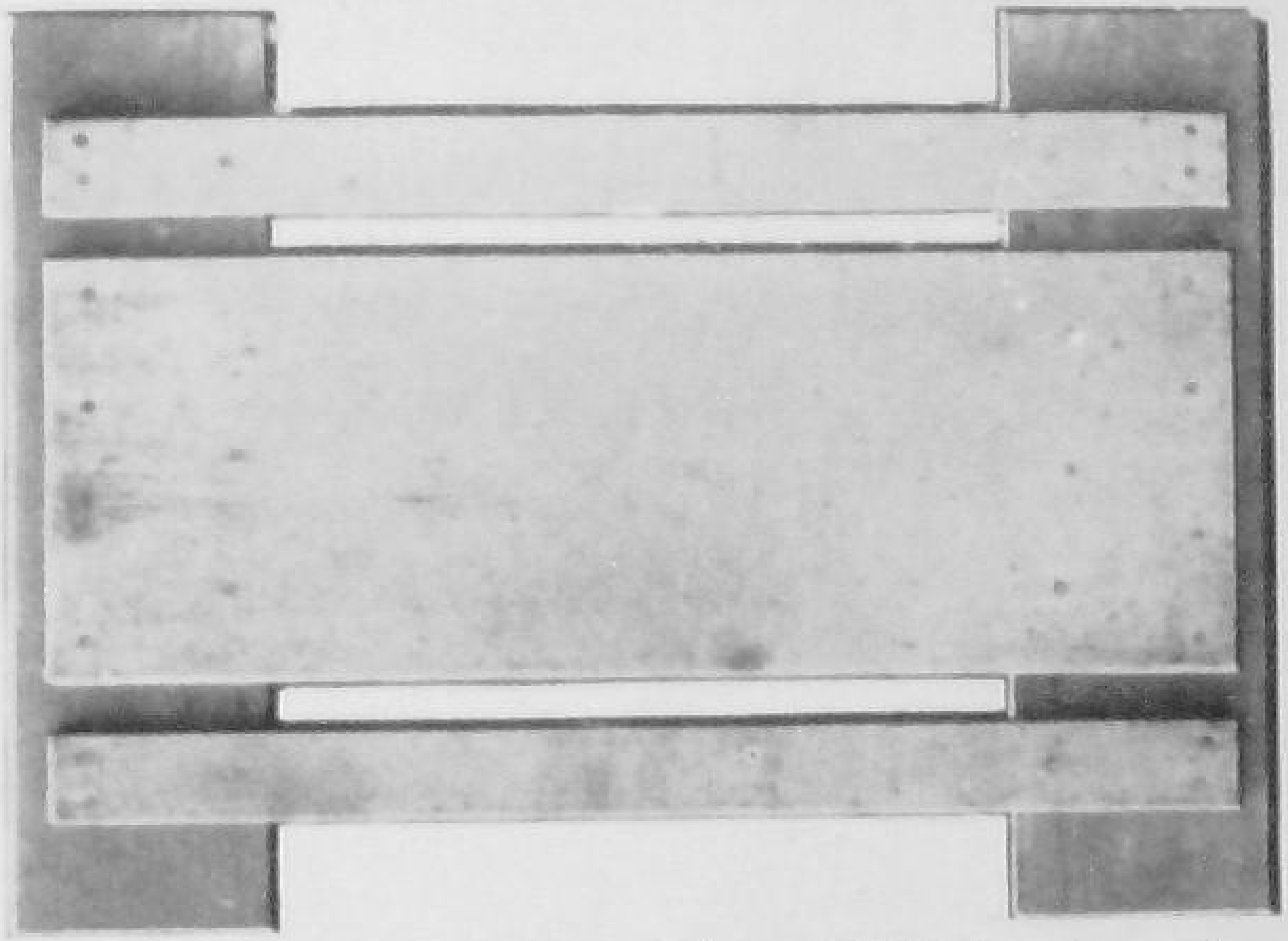


Fig. 47.—Reverse Side of Wiring-board.
(*In wiring Shallow-frames.*)

the under side of the top-bar, which must be held in an inverted position, and at an angle of about 45 degrees. Now run a little molten wax with a spoon or ladle at the highest point in the angle formed by the wax-foundation and the wooden frame, and allow it to run down by its own gravity to the other end. If the wax is sufficiently heated the foundation will be perfectly fixed. The wax should not be overheated, and the best apparatus to use for the purpose is the smelter, shown in Fig. 48. The outer vessel is

for water, and the inner one for wax. In this the wax is kept at a temperature of boiling water, and cannot be burnt. Another plan is to have a saw-scarf cut through nearly from end to end of the top-bar. Two screws are driven into a board about 14 inches apart and filed down to wedge-shape By pushing top-bar over these the opening is widened; the foundation is then inserted, and on lifting frame the wood closes and holds it securely. The illustration Fig. 49 shows a modification of this plan.

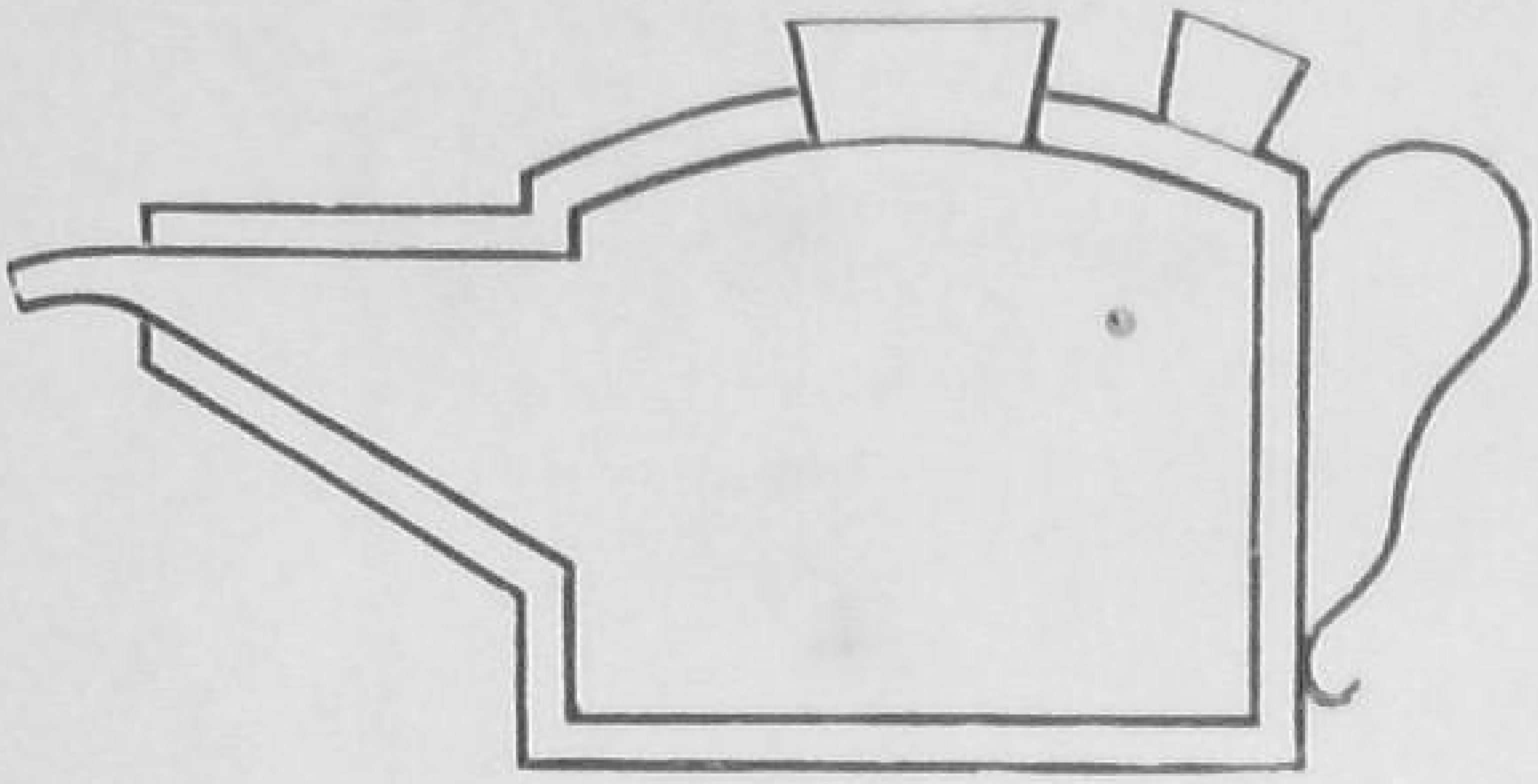


Fig. 48.—Wax-smelter.

Among the methods devised for fixing foundation is Messrs. Abbott Bros.' improved top-bar (patented February, 1887), shown in sections, Figs. 50, 51, and 52. The bar is sawn more than half-way through on the under side, with a wider groove close to it, into which a wedge - shaped piece can be driven.

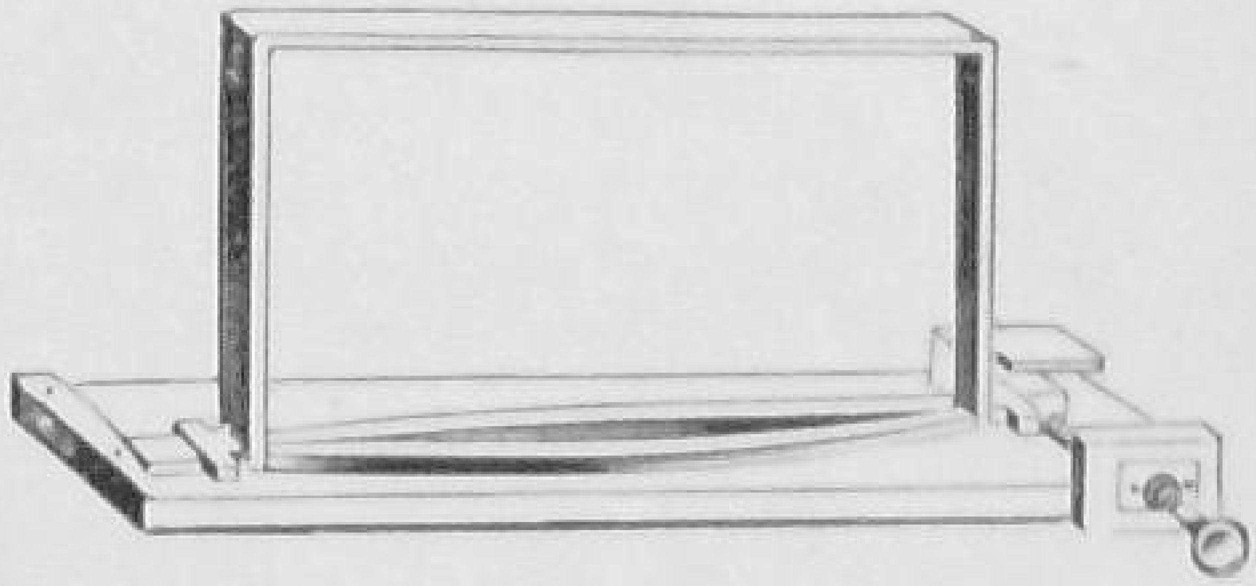


Fig. 49.—Lee's "Automatic" Foundation-fixer.

In Fig 50 (A) the foundation is seen in position, the wedge being firmly pressed into the wider groove by means of the lever (Fig. 52). The wedge can be secured, if desired, by small tacks or brads.

Other frames, in addition to a saw-cut on under side of top-bar, have grooves in the side-bars into which the foundation, being cut large enough, is slid, and held in position by running molten wax along top groove.

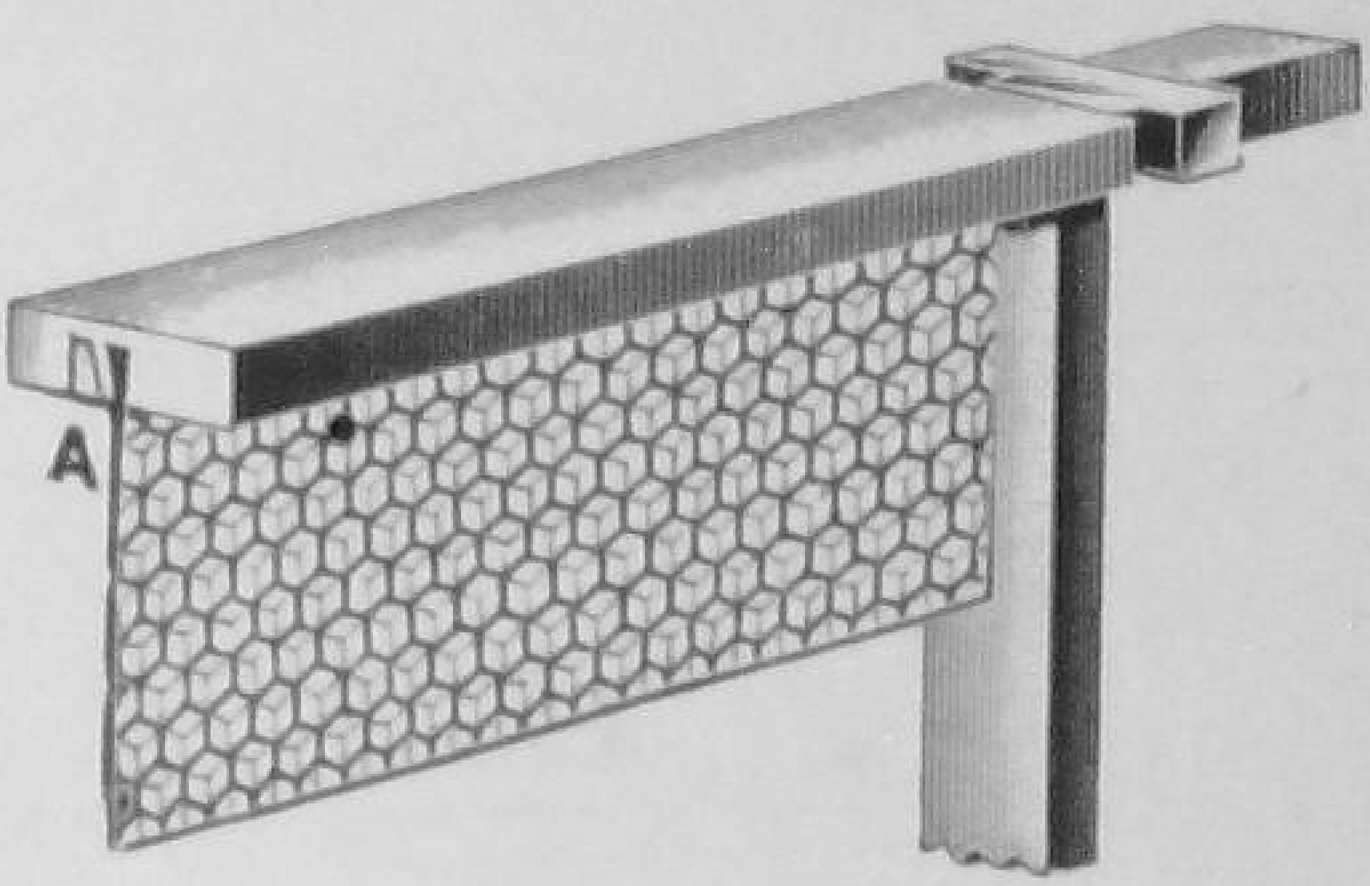


Fig. 50.—Section of Abbott Bros.' (patent) Improved Top-bar.

When stocks are not very strong or forage abundant, some comb-foundation is liable to twist and buckle, because of the bees not thinning it out evenly all over, and one part of the sheet is stretched more than another. This usually happens if the foundation be thin and not strong enough to support the clustering bees. To overcome this difficulty wired foundation has been introduced. This can be purchased ready made and inserted by any of the methods above described, or the bee-keeper can wire his own frames and fix ordinary foundation in them. For this purpose No. 30 tinned wire is used. Thin wire nails are driven through the side-bars where shown in Fig. 53, the ends of these nails being turned to form a hook. Place the frame on guide-block (Fig. 46), and fasten the wire to the hook on right-hand top, then pass it over the one on left-hand top,

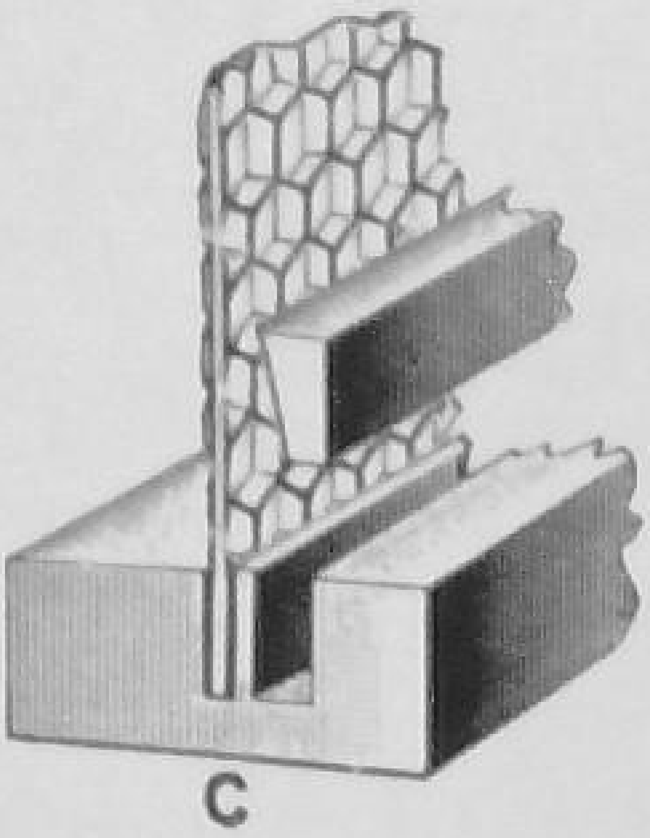


Fig. 51. — Wedge-piece for Securing Foundation.

down to that on the same side at bottom, thence to the lower one on the right. It is then passed over the stretch of wire at the top, and drawn up tight to the bottom hook on left hand, to which it is fastened, as seen at A, Fig. 53. The wire, unless drawn up very tightly, is liable to stretch; it is therefore a good plan to cut it into proper lengths, then fasten one end to a nail in bench, and draw it out as tight as possible before using. Such wire will stretch as much as 2 inches.

Instead of hooks, the side-bar may be pierced with

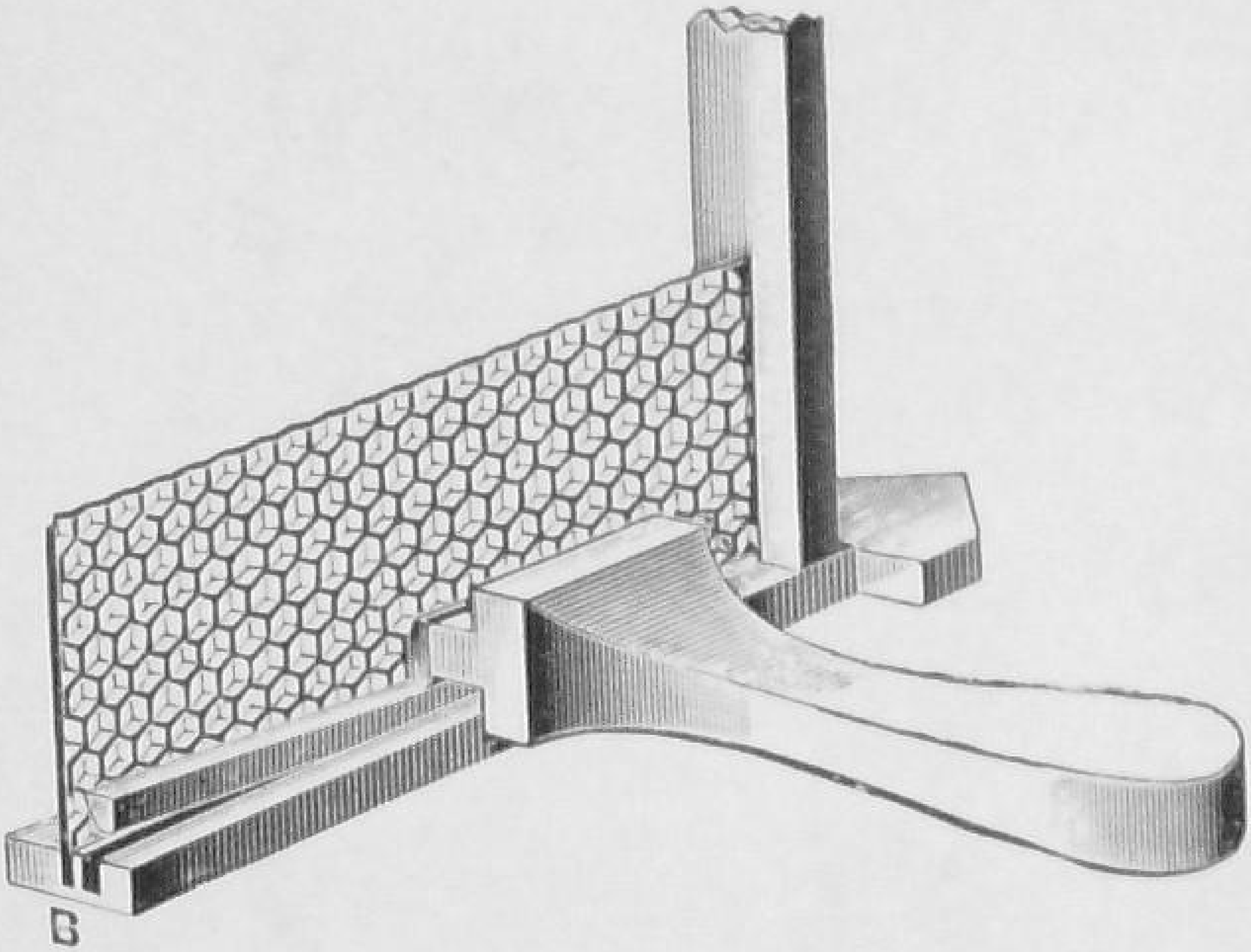


Fig. 52.—Lever for Forcing Wedge Home.

small holes, and by turning down the ends of the wires they can be secured by means of pegs of wood driven into the holes. Lay the guide (Fig. 46) down, place a sheet of foundation on it, and over this put the wired frame, so that foundation touches the top-bar. Have a lighted spirit-lamp by your side; in the flame heat the wheel of the "Woiblet" spur-embedder (Fig. 54), and then place the V-groove of this on wire. Run the wheel along wires from one end to the other. The heat

melts the wax at each point, which cools as fast as the wheel travels forward; the wire will be found covered with wax, and foundation firmly fixed, with no possibility of its stretching.

Another method is by using small staples which

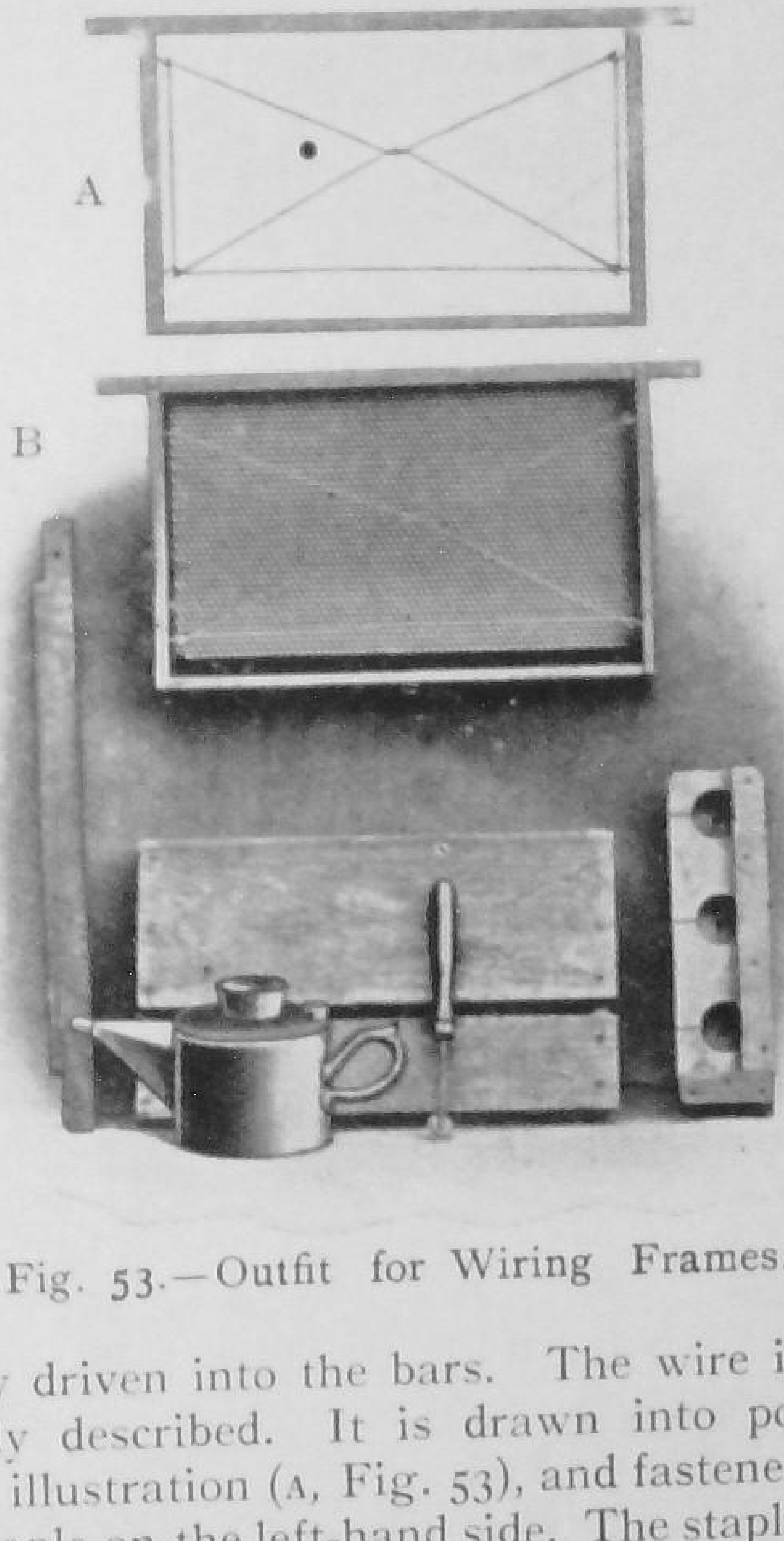


Fig. 53.—Outfit for Wiring Frames.

are partly driven into the bars. The wire is fastened as already described. It is drawn into position, as shown in illustration (A, Fig. 53), and fastened off at the bottom staple on the left-hand side. The staples are then driven into the wood and the wire is stretched perfectly tight. The top-bar should have a saw-scarf,

in which the foundation is fixed, as previously described on page 72, before the wire is embedded. The lower illustration (B, Fig. 53) shows the foundation fixed in standard frame; the remaining implements are what are used in a complete wiring outfit, the guide-block being a modification of that shown in Figs. 46 and 47.

A good way of fixing the thin foundation in sections is with the wax-smelter and block, as described

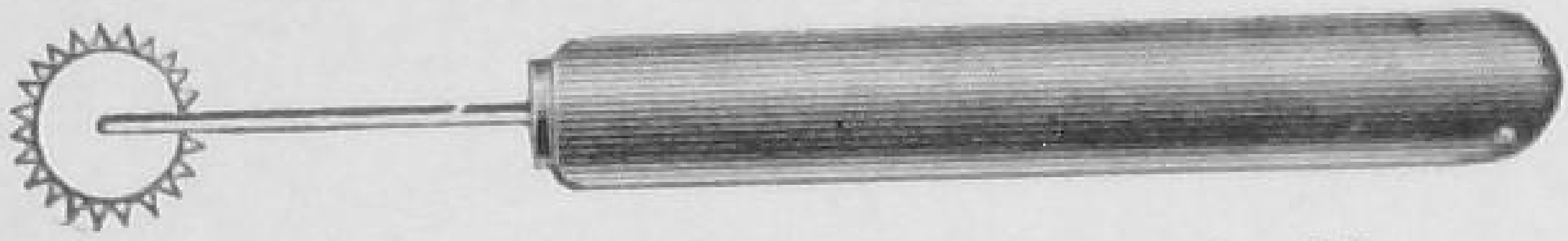


Fig. 54.—"Woiblet" Spur-embedder.

on page 75, the sheet being allowed to fill the section, as it does the Standard frame shown.

Another way is just to dip the edge of the foundation in melted glue and insert it into the slit sawn for the purpose. A very small quantity of glue should be used, or it will show in the comb when this is cut out of the section.

Some manufacturers make sections with a groove all round. The foundation, cut large enough, is inserted into the groove, as shown in Fig. 56; the section is then closed ready for use.

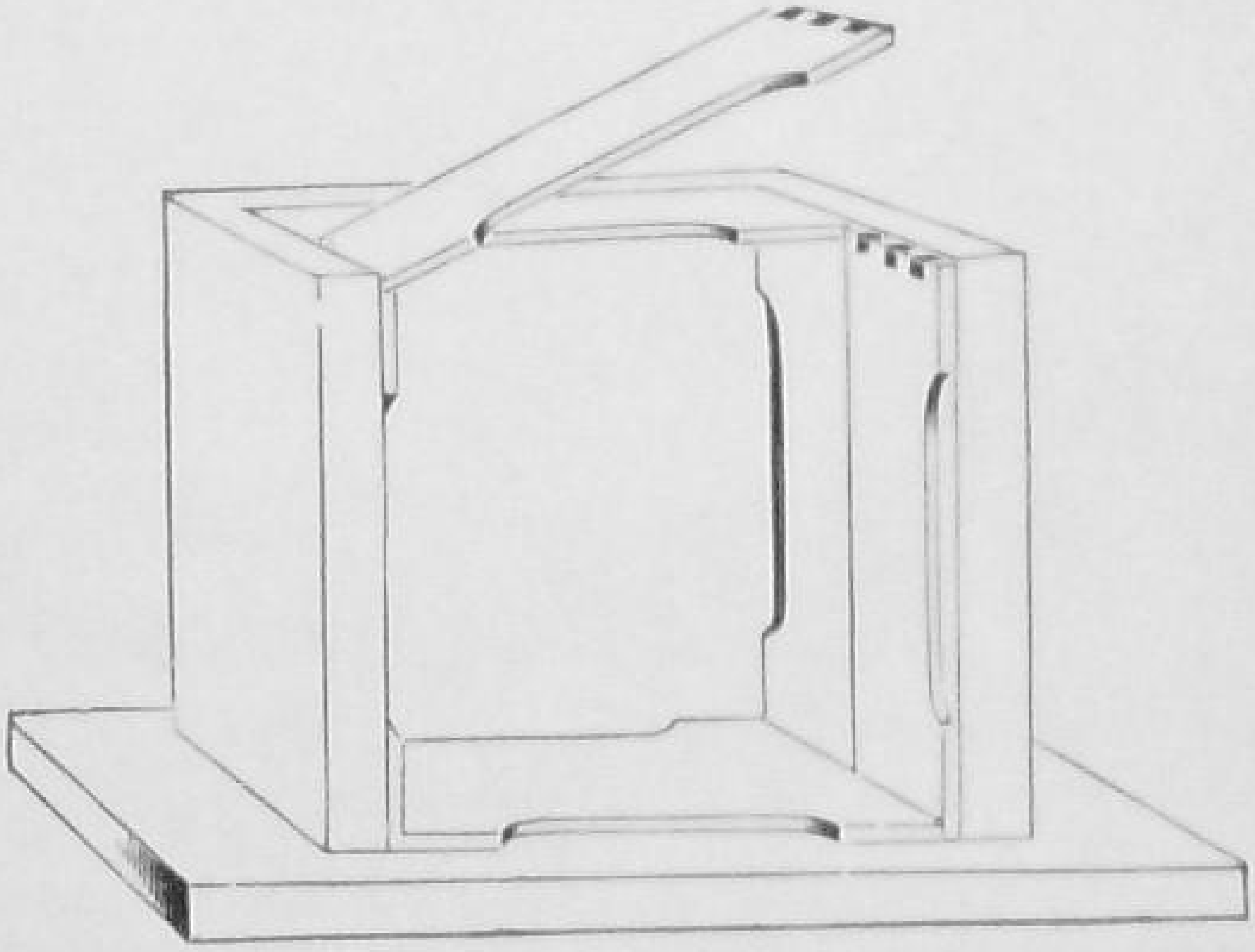


Fig. 55.—Section-block.

Most appliance manufacturers also, in addition to the groove on the sides, now have the top sides of sections sawn through.

In using the block (Fig. 55), a section is first placed therein, after which the foundation is inserted in grooves, and on closing the top is firmly and securely held.

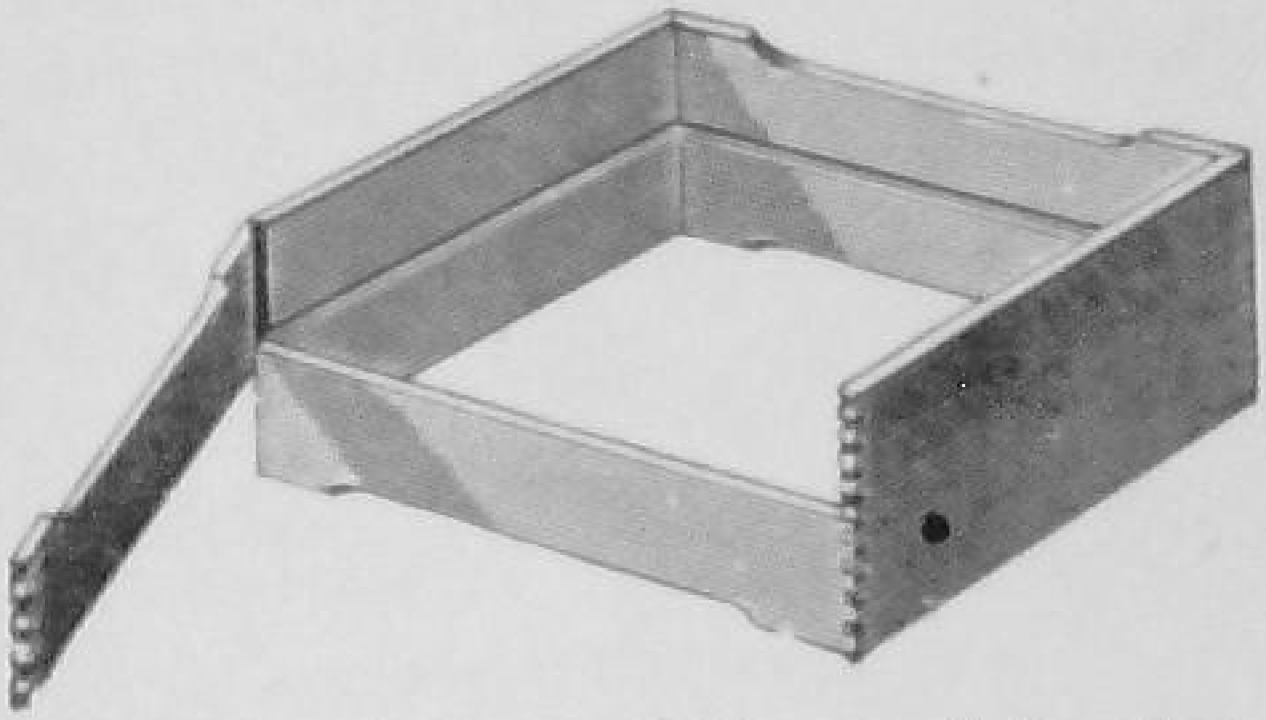


Fig. 56.—All-round Grooved Section.

Among recent devices intended as improvements on the one-piece sections (Figs. 32 and 33) may be named the "No-bee-way" or plain section introduced in America by the A. I. Root Co. In this the projecting shoulders are dispensed with, the section being plain on all sides. The necessary bee-space is secured by means of a separator (or "fence," so named by Messrs. Root), which consists of four slats of thin wood let into the upright end-pieces flush with top edge, but allowing a bee-space below the fourth or lowest slat (see Fig. 57). These slats are so placed

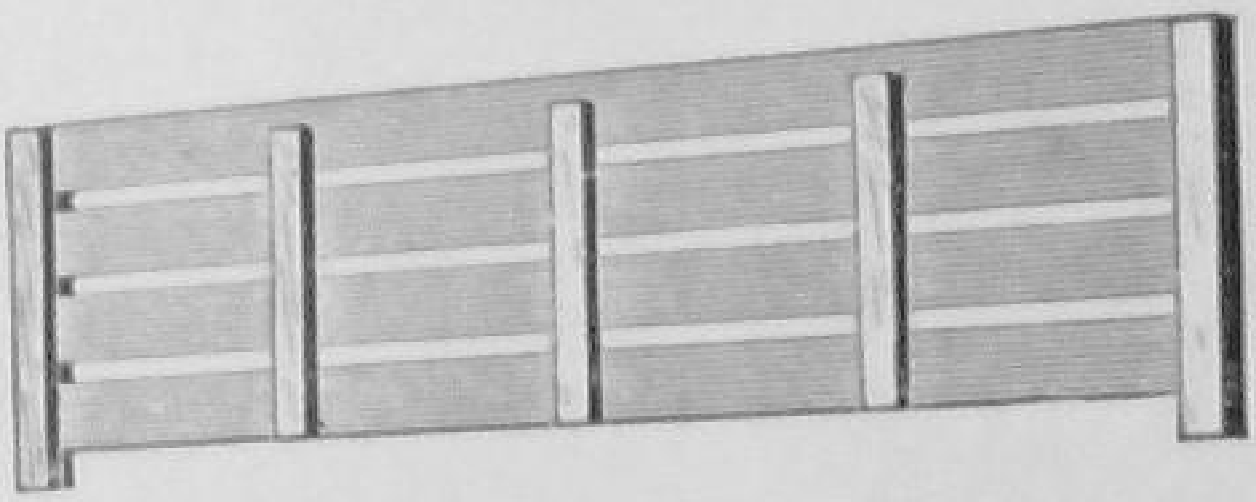


Fig. 57—Cleated Separator.

as to afford a bee-passage between them, and when the cleats are glued to both faces of the "fence," the bees pass freely from one to the other of all sections in the rack. Care should be taken to have accurately-made separators if working on this plan, because if the slats are not carefully spaced, or too far apart, unsightly ridges are likely to occur on the face of the comb.

It is claimed for this method that the accuracy with which the spacing is gauged removes all difficulty in "glassing" sections for market.

Mr. W. R. Garner, too, has registered a tin divider designed to secure the same object.

XIII.--THE HONEY-EXTRACTOR.

By the use of this machine honey may be removed from combs, leaving them uninjured, and they can be returned to the bees to be refilled. When we bear in mind how much honey bees consume to produce

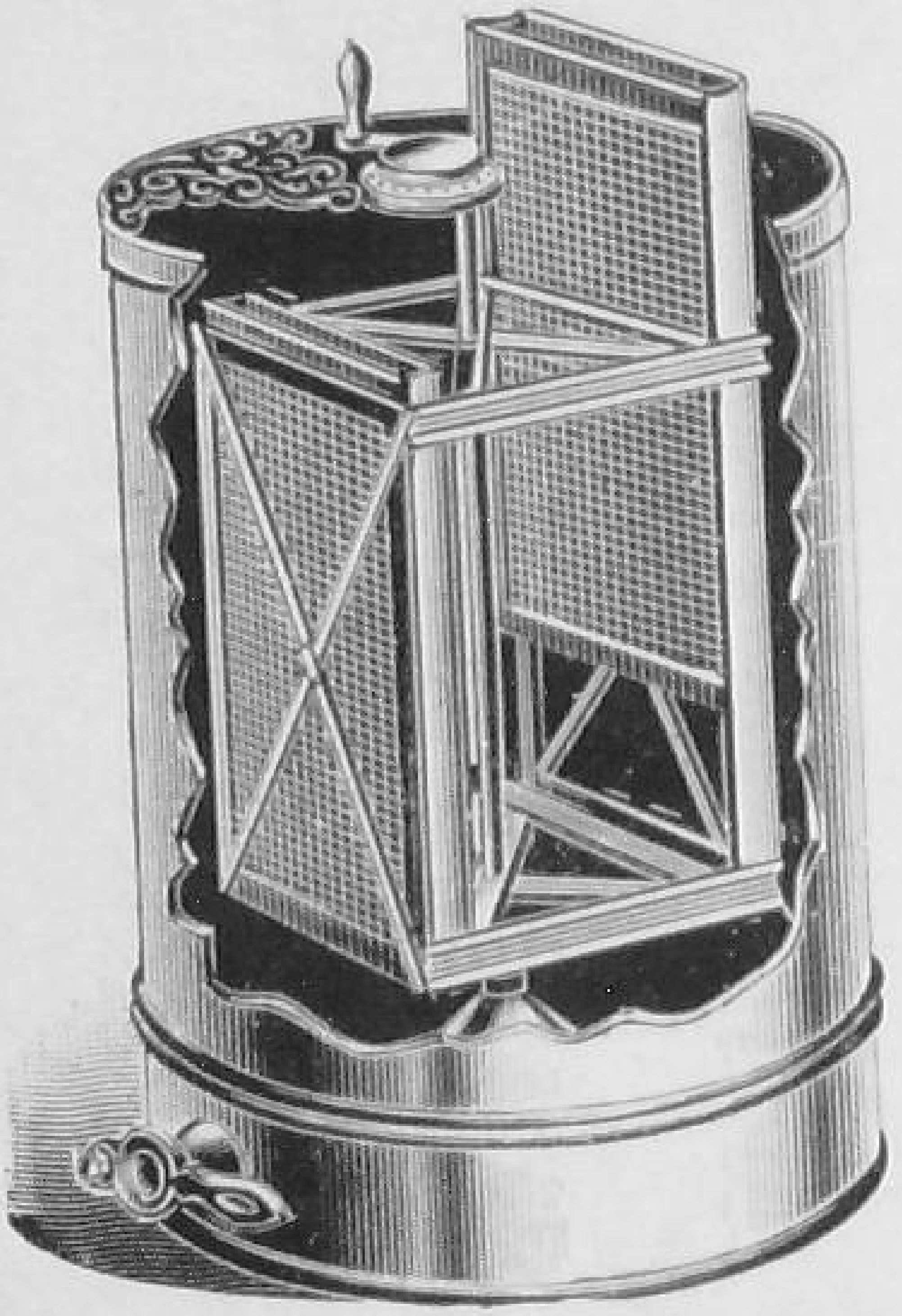


Fig. 58.—"Cowan" Amateur Extractor.

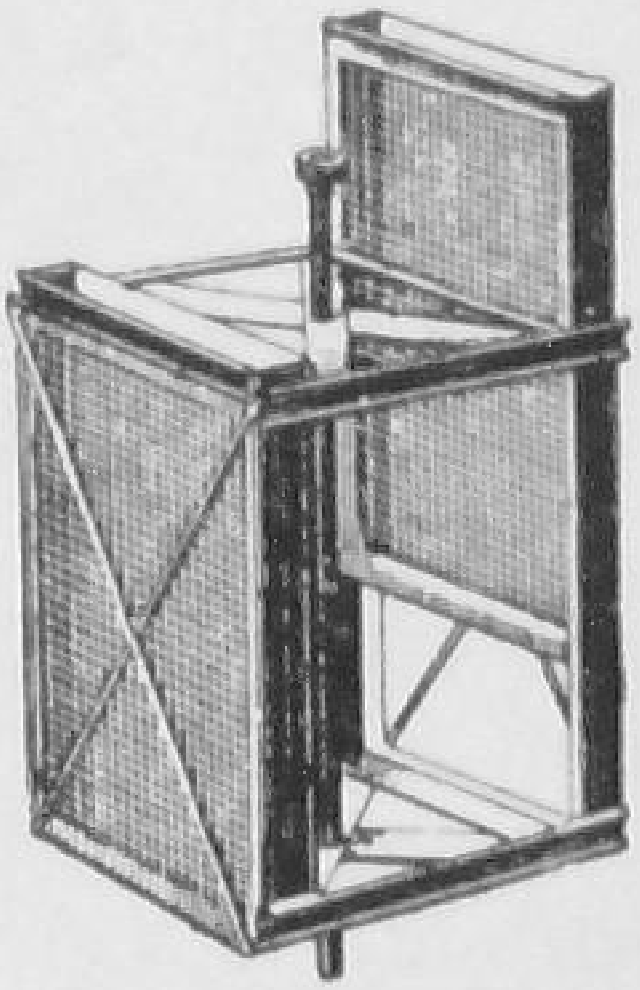


Fig. 59.—Revolving Cage of "Cowan" Extractor.

one pound of wax, we can realise the advantages of a machine which enables us to give them empty comb, and thus save all the labour of comb-building. Nor is this saving of labour to the bees the only advantage of the extractor. In some seasons the brood-chamber often gets so filled with honey that the queen

can find no empty cells in which to lay, and as the production of brood ceases the bees rapidly decrease in numbers. By extracting the honey from brood-combs we are able to give the queen more breeding space, and stimulate the bees to greater activity. The same machine also enables us to secure a large quantity of honey at times when bees cannot be induced to work in sections.

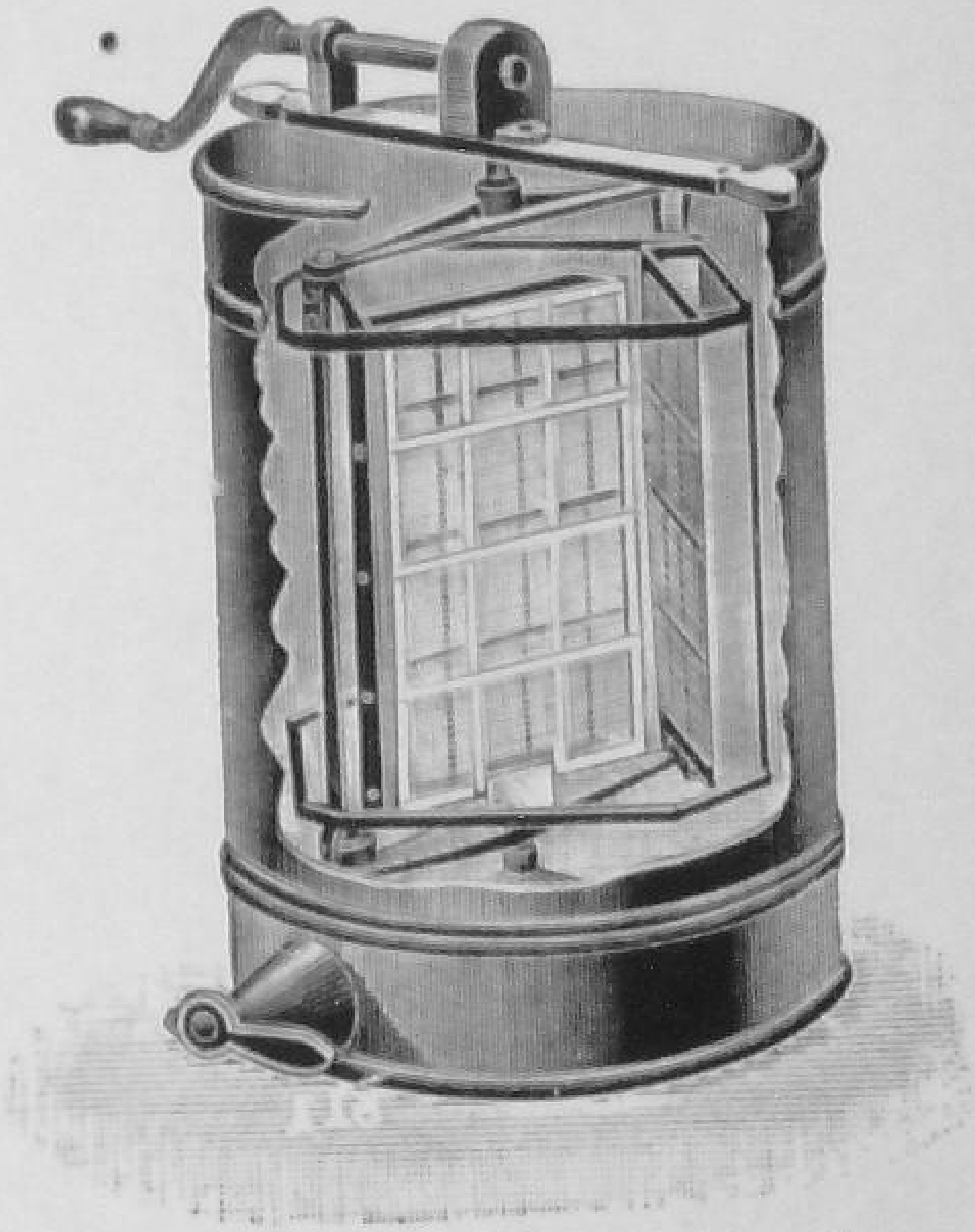


Fig. 60.—"Cowan" Rapid Extractor.

Combs from which the honey is to be emptied are first uncapped with a knife, and inserted in the revolving cage of machine; and when one side is emptied by centrifugal force, caused by the revolving motion, the combs are reversed, and the other side emptied in like manner. Fig. 58 represents the "Cowan" Amateur Extractor, first introduced in 1875. It consists of a tinned iron can, 18 inches in diameter and 24 inches high, having a conical bottom, and a valve which acts as an outlet for drawing off the honey. Inside the can is a framework (Fig. 59), fixed to a vertical spindle, which is set in motion by gearing on the top. In this framework are two cages, which slide in grooves, and are kept parallel to the sides of

the can. When drawn out the cages can be opened, so that combs containing honey may be laid in them without injury. The cages are wide enough to take sections, of which eight of 1 lb. each can be extracted at a time. When the honey from one side of the comb is extracted, the cages are drawn out, reversed, and replaced in the grooves for the extraction of the honey from the other side. The cross-wire braces prevent any bulging, so that there is no danger of the combs breaking out of the frames. This is a cheap form of honey extractor, very simple and efficient, and adapted for general use.

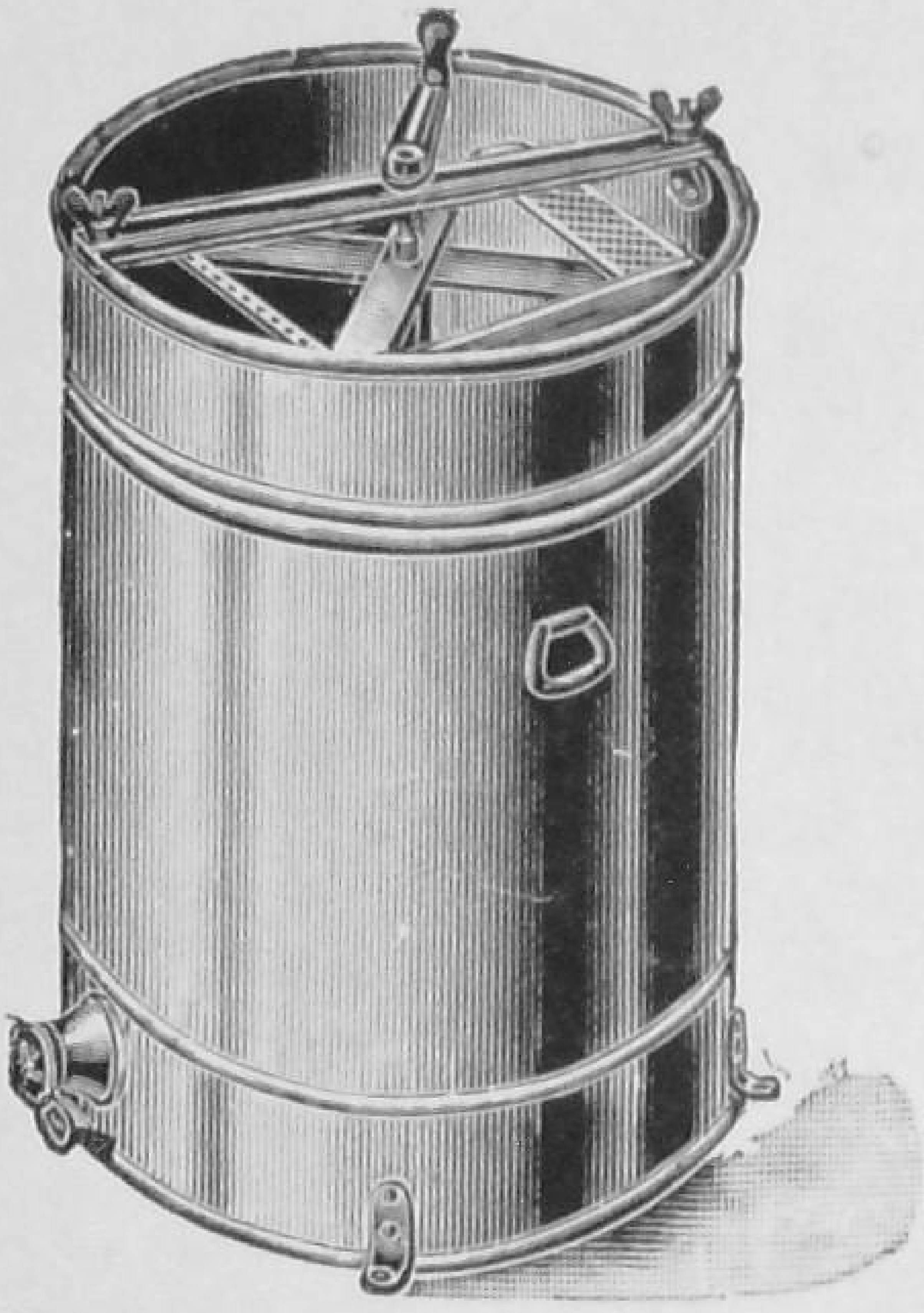


Fig. 61.—The "Cottage" Extractor.

Fig. 60 is the "Cowan" Rapid Extractor, introduced in 1875, and now extensively used in this country and in America. The can is similar to Fig. 58, but the internal arrangement is different. In this machine the cages have not to be taken out for the purpose of reversing the combs, as they are suspended on pivots at opposite corners, so that when one side is extracted the cages swing round on these pivots, and place the combs in position for extracting the other side. A great saving of time is thus effected. These machines are also made to take four or six frames.

Fig. 61 represents a cheap form of extractor for use of artisans and cottagers. The frames have to be lifted out for reversing, and there is no gearing, but otherwise it is a serviceable extractor for ordinary use. The cheapest form of extractor is that known as the "Little Wonder," introduced by Mr. Abbott in 1875, which extracts one comb at a time with a little extra labour, and answers the purpose of those who only keep one or two hives.

There are several other forms of extractors in the market, some of them having serious objections.

It is important that the combs should stand parallel to the sides of the can, because if they are not so made the upper part of the comb describes a larger circle when revolving than the lower part, consequently the machine has to be driven at a greater velocity to extract the lower portion of the comb than it does the upper. In doing this there is danger of breaking the combs. The cages should be at a sufficient and proper distance from the central spindle; if too near, as in machines constructed without a knowledge of the principles of mechanics, only the centre cells are entirely extracted, leaving the outer ones partially filled with honey. For the same reason machines made to take frames in the same position as they hang in the hives are to be avoided. If the frames are long, such a machine, to be efficient, should have a very large diameter, which would make it too large for convenient handling. Extractors should be made of metal, and all parts coming into contact with honey must be tinned. Zinc or galvanised iron should on no account be used, as the acid in the honey acts upon zinc to the detriment of honey. Wood is objectionable, as it absorbs honey, setting up fermentation, besides being difficult to clean. For heather honey-press, see page 87.

XIV.—WAX-EXTRACTING.

In every apiary of six or more hives there will always be combs and scraps of comb fit only for melting into wax. These should be melted down as soon as possible, for if left to lie about they afford a harbour for wax-moth.

The simplest apparatus for this purpose is Mr T. I Weston's Solar Wax-extractor (Fig. 62). It

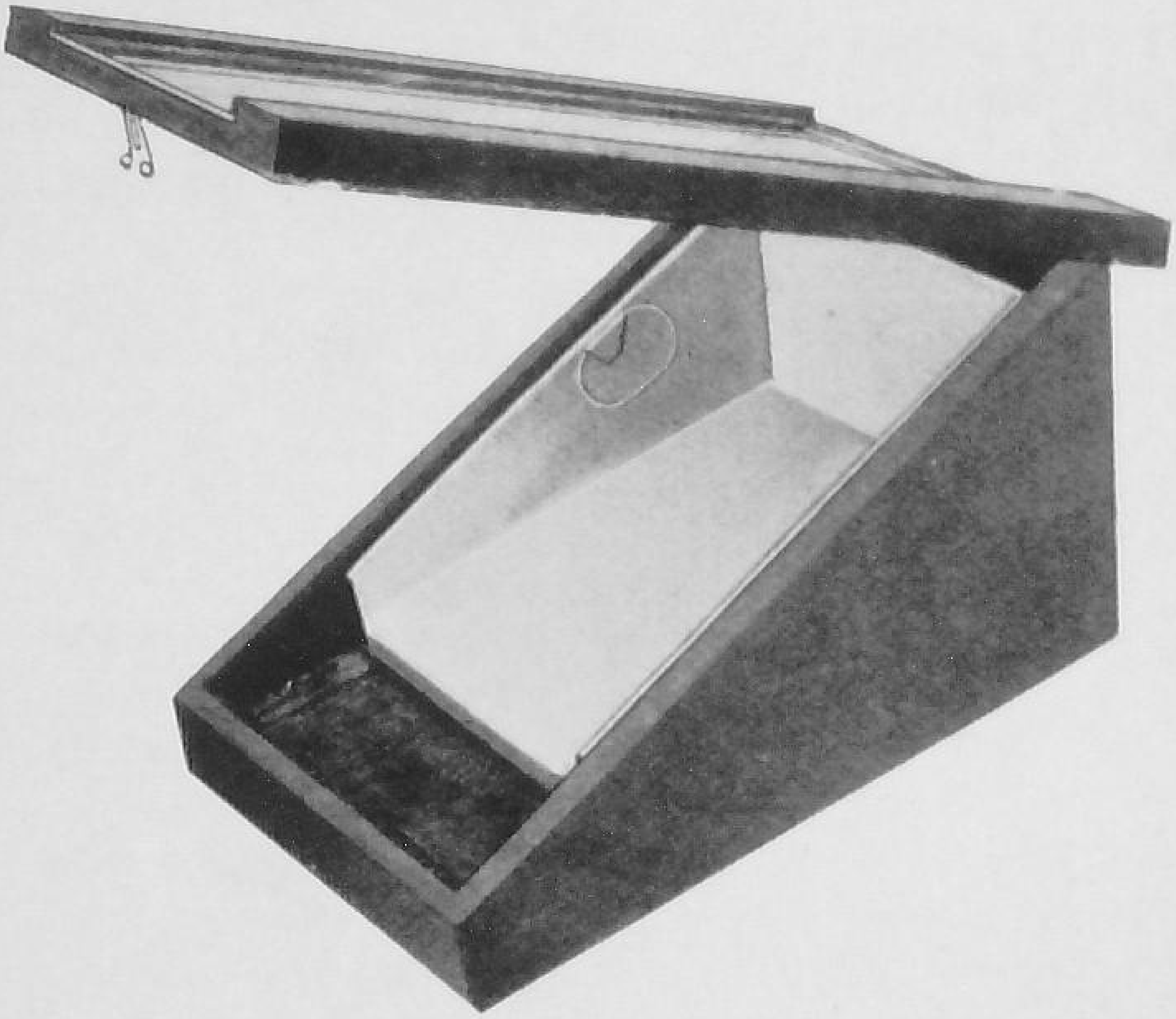


Fig. 2.—The "Weston" Solar Wax-extractor.

consists of a wooden box with a double glazed frame sloping from back to front. A slightly-inclined tin tray fits inside, and on this the combs or pieces of wax are laid. If the apparatus is now placed in the sun, so that the rays strike the sloping glass, the wax will melt and run quite pure into the receptacle in front of the tray, leaving nothing but the residue behind on the wire gauze. Another method is by

using the wax-extractor devised by Professor Gerster (Fig. 63). It consists of an outer tin cylinder, A, having a dish, D, inside, communicating with the outlet, C. Between this dish and the outer cylinder there is a space to allow the steam to pass up to the basket. There is also a tube up the centre of basket for the same purpose. The perforated tin basket, B, stands about an inch from the bottom of the dish. When working, the basket, B, filled with comb, is inserted in cylinder, A. The whole is then placed over a pan containing water, on the fire. When the water boils, steam passes through the openings in the direction shown by arrows, and melts the wax, which oozes through the perforations in the basket into the dish, and then runs from spout, C, into a basin of water, leaving the refuse in basket, B. Wax extracted by this method is free from impurities, and of a beautiful colour. This extractor can also be used for putting in cappings from the combs when we are extracting; the honey is drained from them, and when the basket is full the wax may be melted. The machine, when not in use, should be kept covered, with the outlet corked, and every scrap of comb put therein as it accumulates.

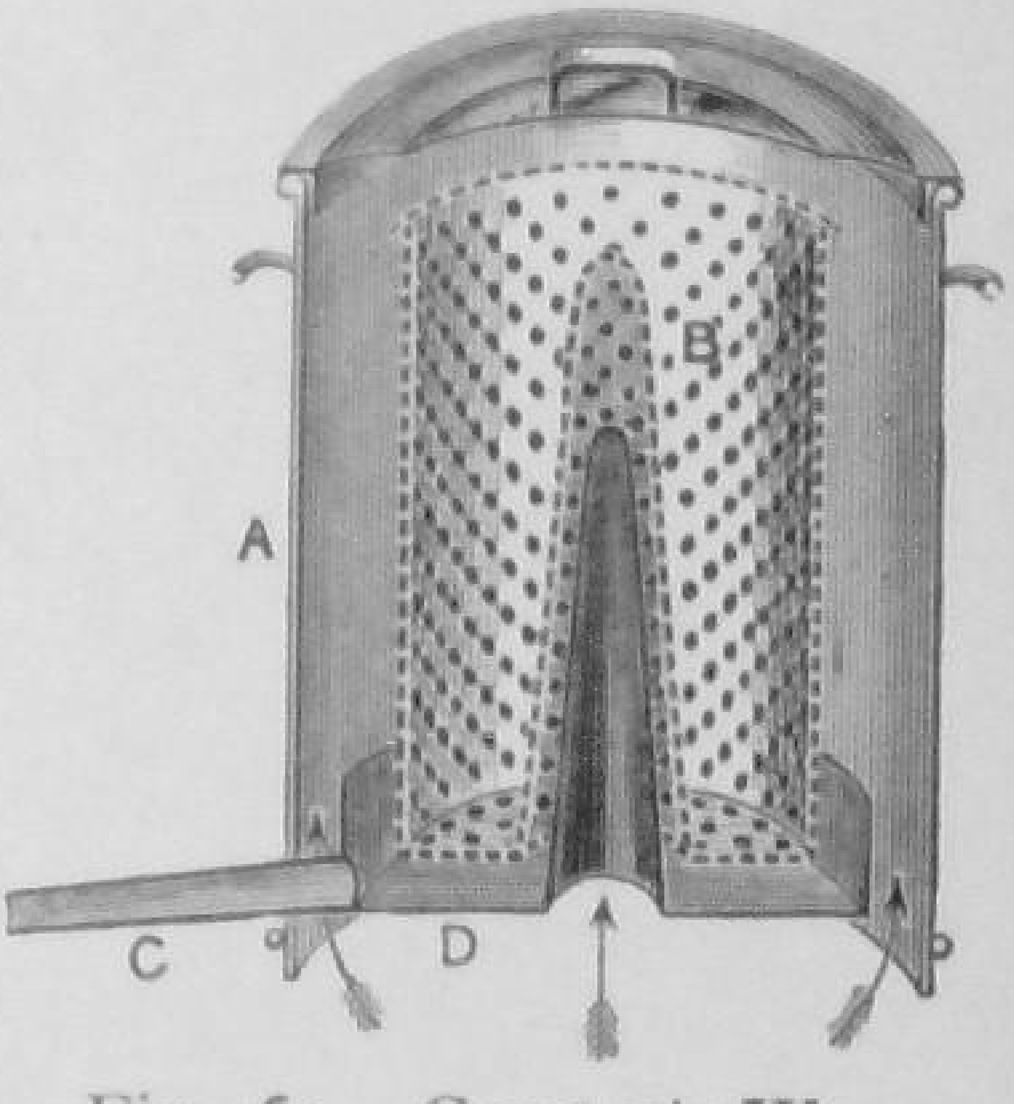


Fig. 63.—Gerster's Wax-extractor.

Where only a small quantity of wax has to be melted, the combs may be placed in a fine sieve over a pan of water and put into the oven. The heat of the oven melts the wax, which drops into the water, and it can be taken off in a cake when cold.

XV.—SURPLUS EXTRACTED HONEY.

Within the last few years it was the general custom among advanced bee-keepers to use the standard frame in both brood and surplus chambers. When this plan prevailed the rule was to go round the apiary at intervals during the honey season and remove two or more frames from every hive, in which sealed combs were found, for removal and extracting indoors. The frequent disturbance, caused by opening hives, and the subsequent replacing of wet combs for refilling, however, entailed much labour and care as well as skill on the part of the operator in order to avoid starting "robbing" and its attendant evils; besides the risk of spreading foul brood in the apiary through promiscuous interchanges of combs from different hives. With ordinary or less experienced bee-keepers, considerable mischief, and sometimes disaster, arose from want of the necessary skill in management, and in consequence it has led to the general adoption of the shallow frame box (page 64) for surplus when working for extracted honey. Not only so, but it is found advantageous to leave surplus-chambers undisturbed till the combs are sealed over, then removing the full super instead of lifting out a few frames at a time, as in the former method.

The removal of surplus honey is now rendered comparatively simple and easy by means of the super-clearer (see page 58), which has almost entirely done away with the trouble formerly experienced owing to bad management in taking honey from hives. It therefore only needs a careful observance of the following details in using the super-clearer to prevent the mischief and annoyance formerly complained of.

After quietly removing hive-roof, lifts, and quilts, gently raise the corner of surplus-chamber with the

point of a screwdriver sufficiently high to allow of inserting a small wedge (made by sharpening a bit of broken section); after raising each corner in the same way, blow in a puff of smoke on each side of the opening so made; then, with a screwing motion, at once lift off the super and set it on the clearer (Fig. 38), previously placed on a stool; if the bees are seen crowding on the uncovered frame-tops, drive them down with a puff of smoke before lifting the super, with the clearer on its under side, and replacing it on the hive. The " screwing motion " used when lifting supers is necessary because of severing brace-combs, if any, attached to the frames below.

The illustration Fig. 65 shows the method of uncapping a shallow frame for extracting with a

Fig. 64.—" W.B.C." Uncapping Knife.

" W.B.C." uncapping knife (Fig. 64)—which is one of the best for the purpose. If this knife be withdrawn from the hot-water vessel or knife-heater shown, and wiped dry, a whole sheet of wax-capping may, with a little practice, be removed at one cutting.

The uncapped combs are then placed in the cages of the extractor, and a few turns of the handle will throw out all the honey from one side; the cages are then reversed, and the honey extracted from the other side. Be careful to turn only just fast enough to throw out the honey. A little practice will soon enable the bee-keeper to judge the proper speed. It is not recommended as a rule to extract from brood-combs, and beginners should not make the attempt, but it may be expedient sometimes to do so.

Heather honey is much more difficult to extract; for this purpose the "Rymer" Honey-press has been

Fig. 65.—Uncapping Shallow Combs for Extracting.

found the most perfect. By referring to Fig. 66 it will be seen that the press is lined with plates grooved vertically. The combs are cut out of the frames, and,

without uncapping, are wrapped in one thickness of straining calico, and placed between the grooved plates faced with woven wire, eleven to twelve meshes to the inch. This wire prevents the combs being forced into the grooves when pressure is applied, which forces the honey through the straining calico into the vertical grooves, and it runs down, quite clear, into the receptacle below. The pressure is so even that every particle of honey is extracted, and nothing remains but a nearly dry sheet of wax.

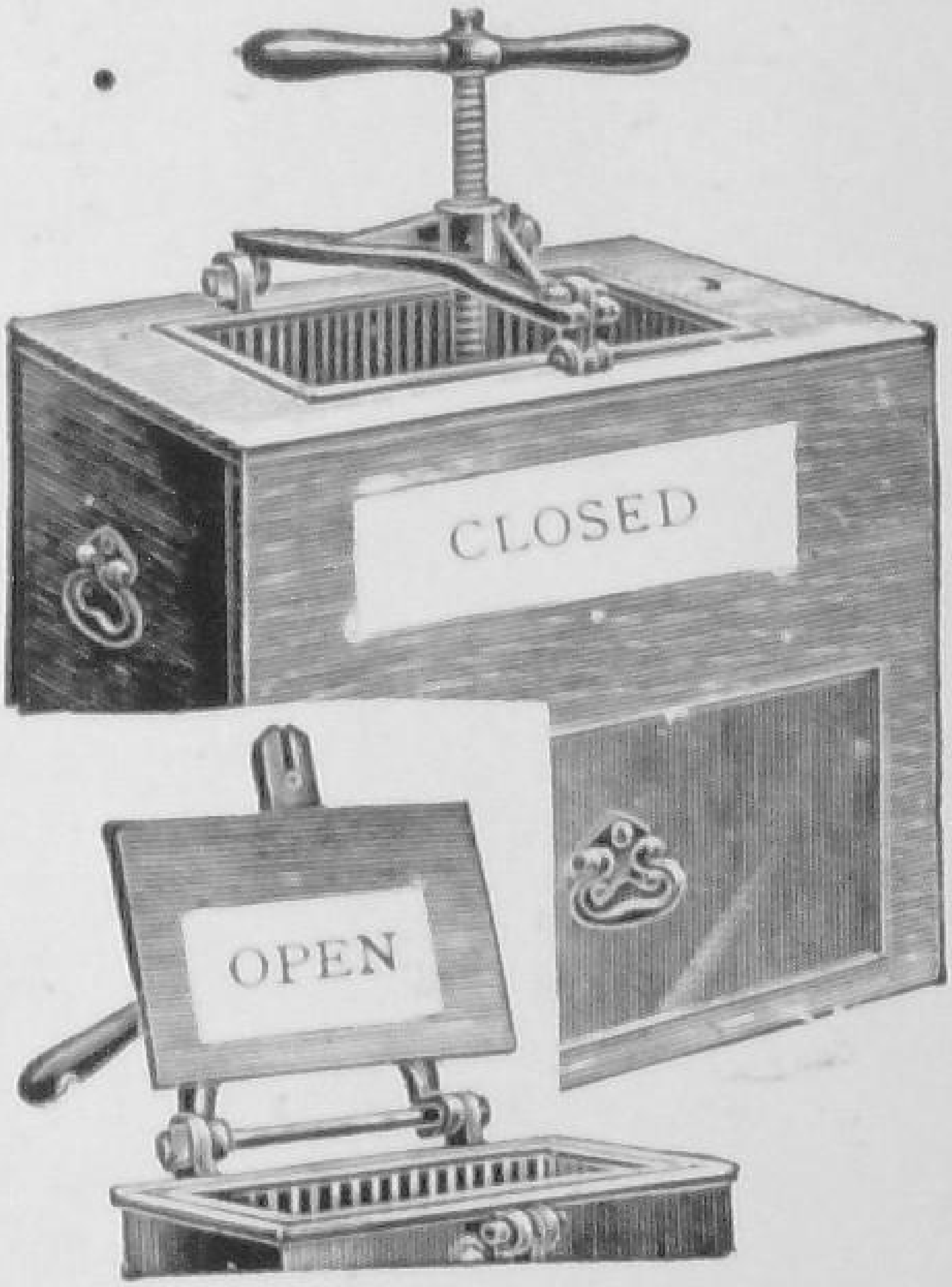


Fig. 66.—"Rymer" Honey-press.

After a quantity of honey has been extracted, strain it by means of the appliance shown (Fig. 67). If the extractor can be raised high enough to allow of the honey running from the usual treacle-valve at bottom into the flannel strainer, seen raised up in Fig. 67, it will pass through into the can below. It may then be allowed to settle and ripen. If kept in a warm place at a temperature above 80 degrees Fahrenheit, in a few days it will be fit for putting into jars, and can be drawn off by means of the valve at the bottom of the can. The thin, liquid portion of honey which floats on the top may be used for feeding bees, as it is liable to ferment in the jars after a time.

Although the inside gearing of an extractor is generally made to take out, it is not necessary to do so for cleaning. Revolve it, and from a kettle pour boiling water on to every part of the inside; pour this off and rinse, and the machine will be found perfectly free from honey.

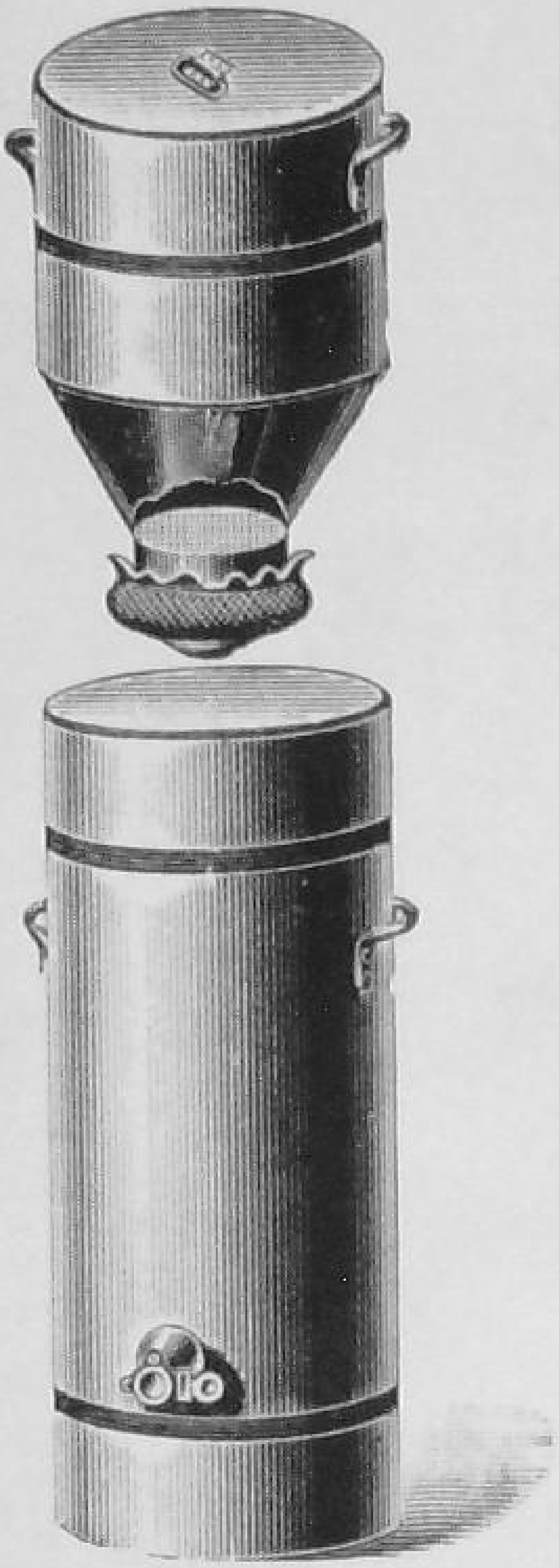


Fig. 67.—Honey-ripener.

Extracting should always be done indoors to prevent robbing; nor should combs ever be removed for extracting if robbers are troublesome, robbing being a sure sign that the yield of honey is failing.

Wet combs for cleaning up by the bees should always be returned to the hives after sun-down, otherwise the odour of the honey will attract robbers, and sometimes cause the bees to fight among themselves.

XVI.—MARKETING HONEY.

The market value of honey depends largely upon the manner in which it is offered for sale; that which presents the most attractive appearance sells readily at the highest market price.

When completed sections (Fig. 68) are removed from a hive, they should be placed in a storing-crate, shown on page 59.

When preparing for market, all sections should be graded into three classes. Those of the first class should consist only of the best clear, even, light-coloured, and free from defects, seconds and thirds being graded according to quality. It is also important that the wood of the sections be scraped clean and free from propolis. When sorted and cleaned they can be neatly labelled with the name of the producer, and, if known, the source from which the honey

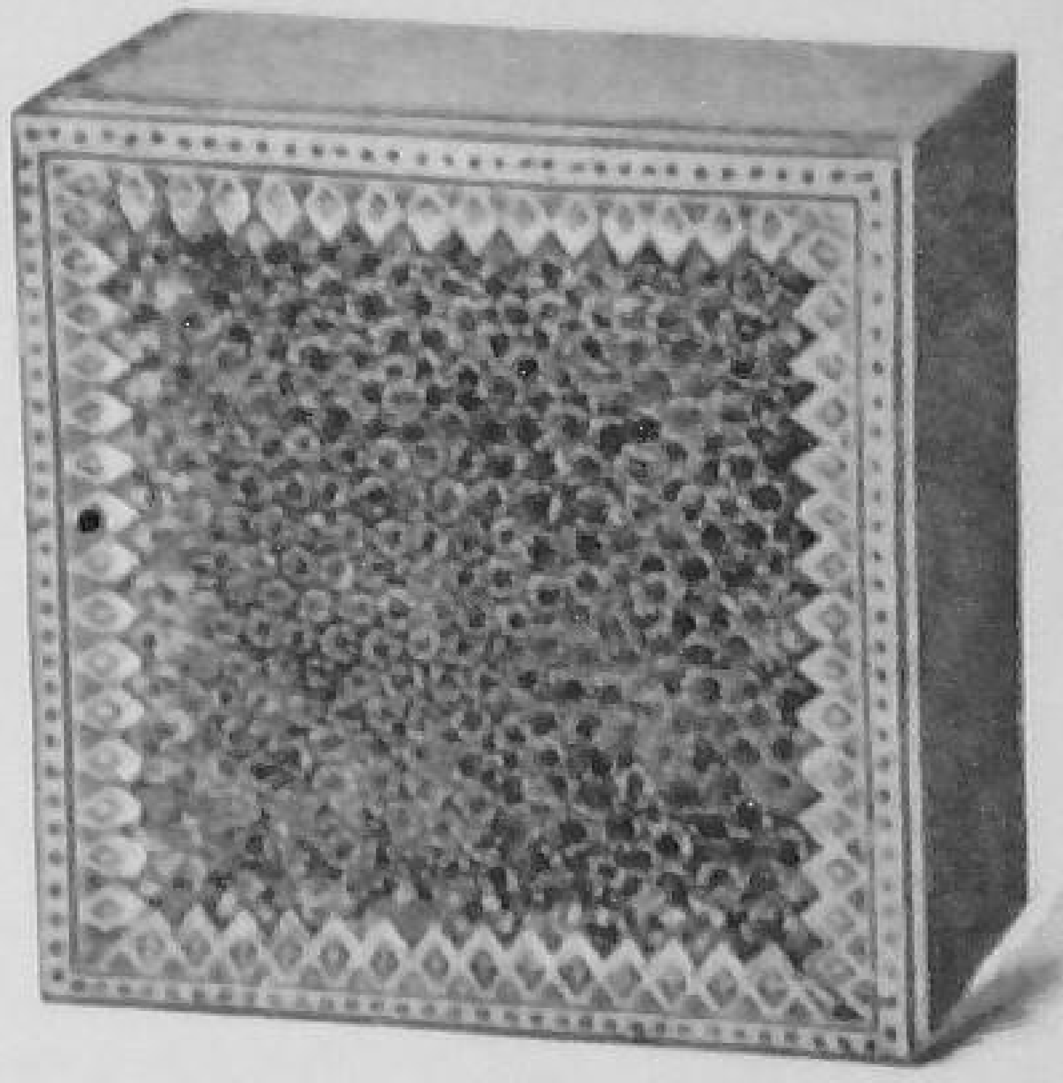


Fig. 68.—Completed Section.

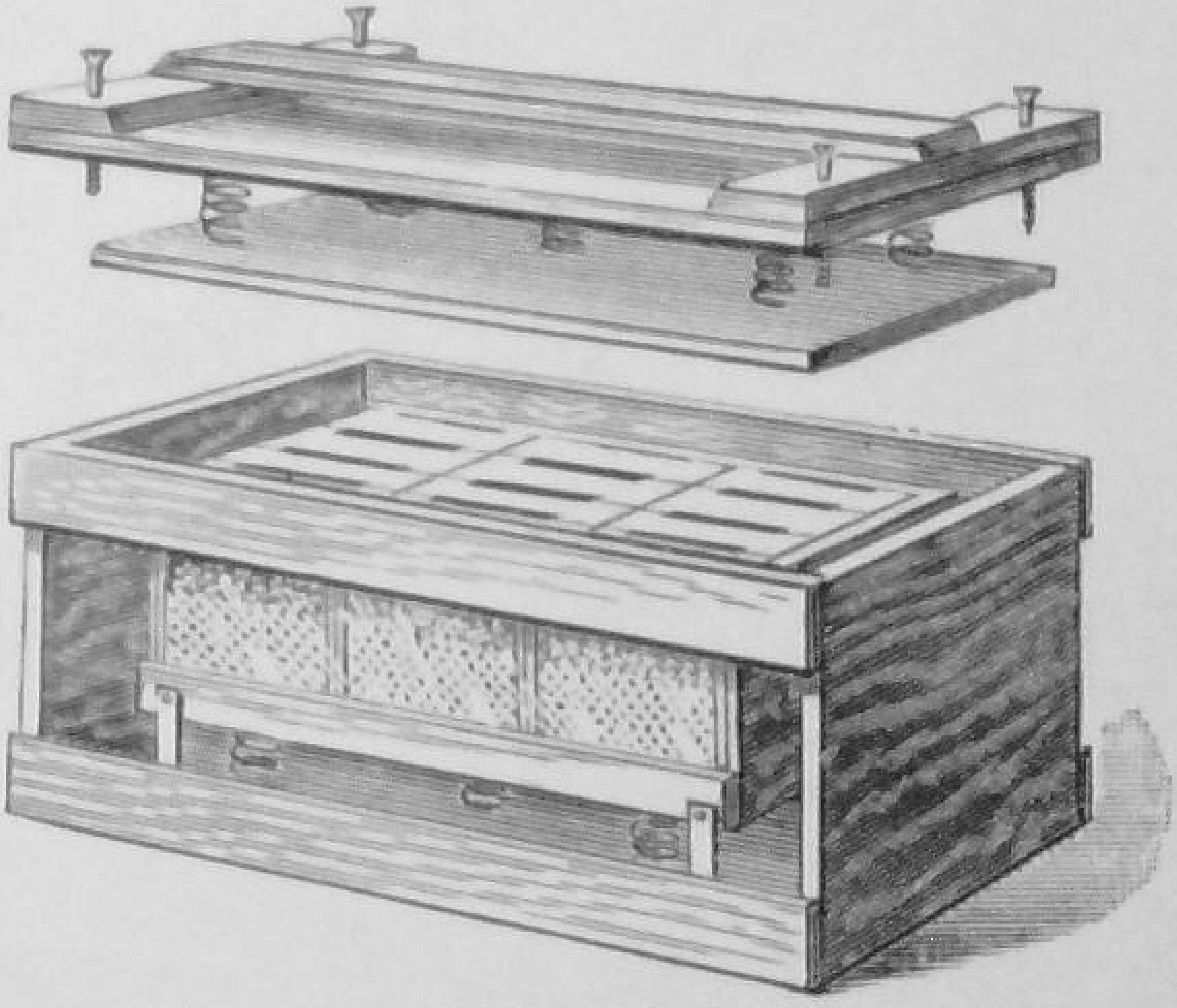


Fig. 69.—Honey Marketing-crate.

was derived should be stated. Second and third qualities must each be kept separate and sold at a lower price.

The best marketing-crates have springs at top and bottom to prevent the combs from being damaged by the jarring during travelling (Fig. 69), and are made to hold one dozen sections. Being glazed on two sides, the contents are visible, and this ensures careful handling. When filled with neatly-finished sections they show off to the best advantage, and can be thus preserved for a great length of time if kept in a warm room.

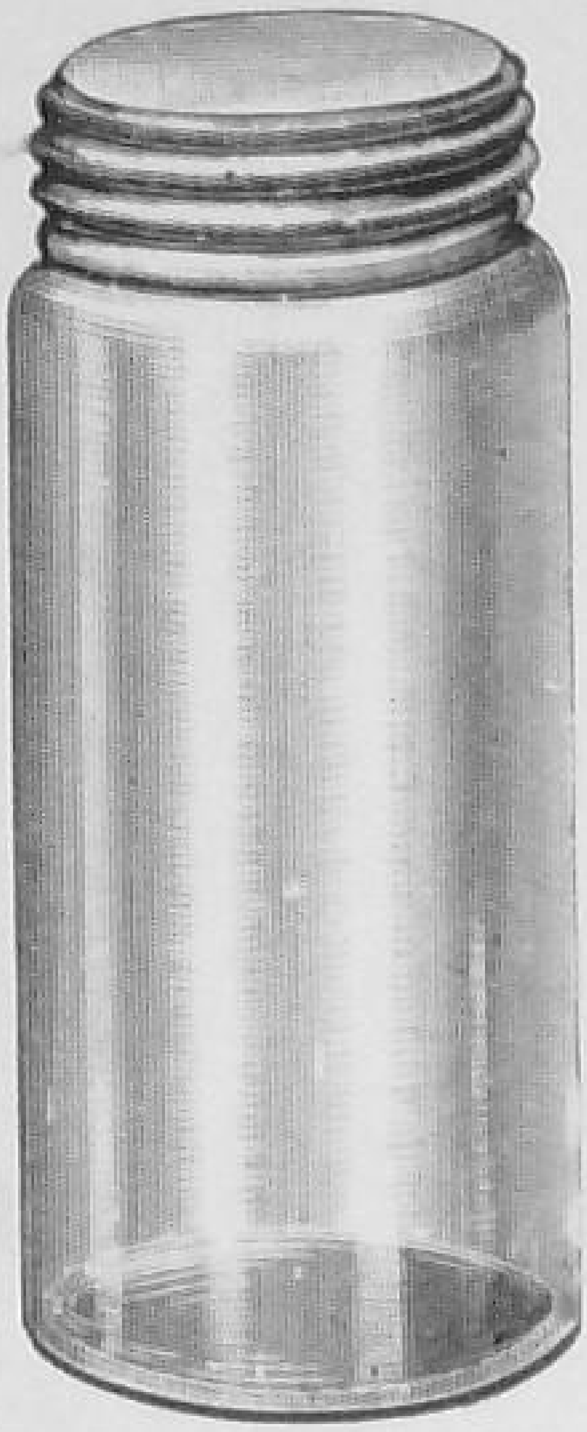


Fig. 70.—1-lb. Jar.

Extracted honey should be put up in neat jars of 1 lb. (Fig. 70) with ornamental labels. It is important that the glass be clear, otherwise it spoils the appearance of the honey. Pure extracted honey will usually granulate if kept at a low temperature. The labels on the jars should draw the purchaser's attention to this important fact; and when the public have learned that granulation is a test of its purity, English honey must have the preference to that imported, which is often mixed with glucose, ostensibly to prevent its granulation. The following is a specimen of label recommended:—

TAKE NOTICE

This honey will candy, or become white and hard, as soon as cold weather begins, and this candying is, in fact, the best proof of its purity. To restore honey to liquid form, immerse the jars (after removing the caps or covers) in a vessel partly filled with water; then heat gradually till the finger cannot be comfortably held in the water. When thoroughly melted and clear, remove the honey and cover down while quite hot. If this be done, it will usually not candy again for a long time. The jars, while heating, should stand on strips of wood, thus allowing the water to pass below and round the jars.

Jars with white metal screw-caps and cork wads (Fig. 70) are in great favour. In addition, there should be a label giving the producer's name, and stating the source from which the honey was gathered.

The best crate for packing honey is shown in Fig. 71. It is in compartments, with a layer of corrugated paper at the bottom and on the top; also surrounding each jar. None but the best honey should be sent to market, all of inferior quality or unripe being utilised in the apiary. The retail value

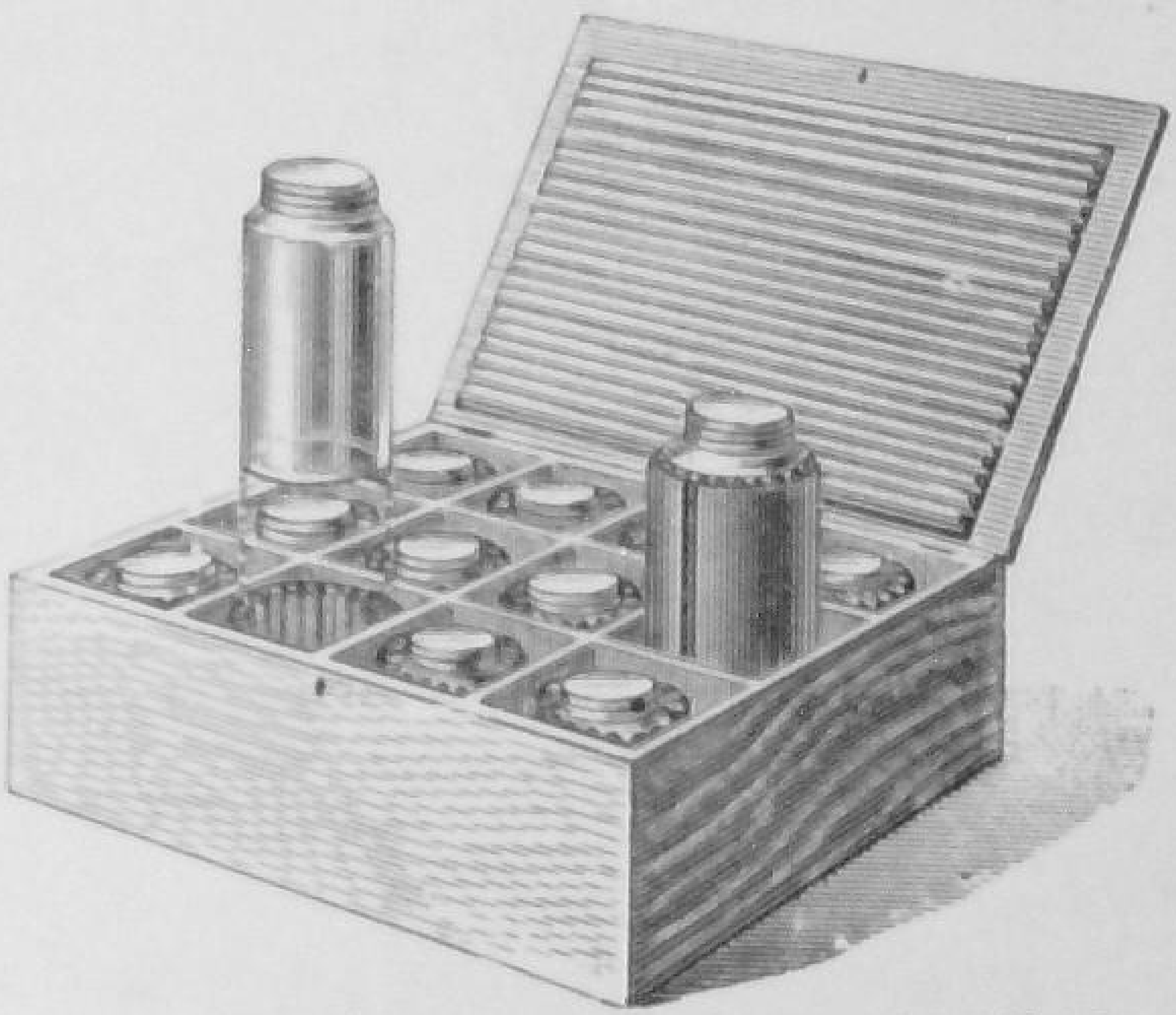


Fig. 71.—Packing crate for Honey in 1-lb. Jars.

varies from 9d. to 1s. a pound in sections, and from 8d. to 10d. a pound for extracted honey. But, as a rule, prices depend upon the supply and demand.

British honey is rapidly increasing in favour, and at shows that which has the neatest appearance readily finds a sale. None but the very best honey should be exhibited in competition; the British Bee-keepers' Association and most County Associations requiring that sections be sent to shows in marketing-crates.

At many exhibitions the sections are placed in cardboard boxes (Fig. 72), having glass in front and at the back, so that both sides of the comb may be examined. A narrow lace-paper border adds considerably to their neat appearance.

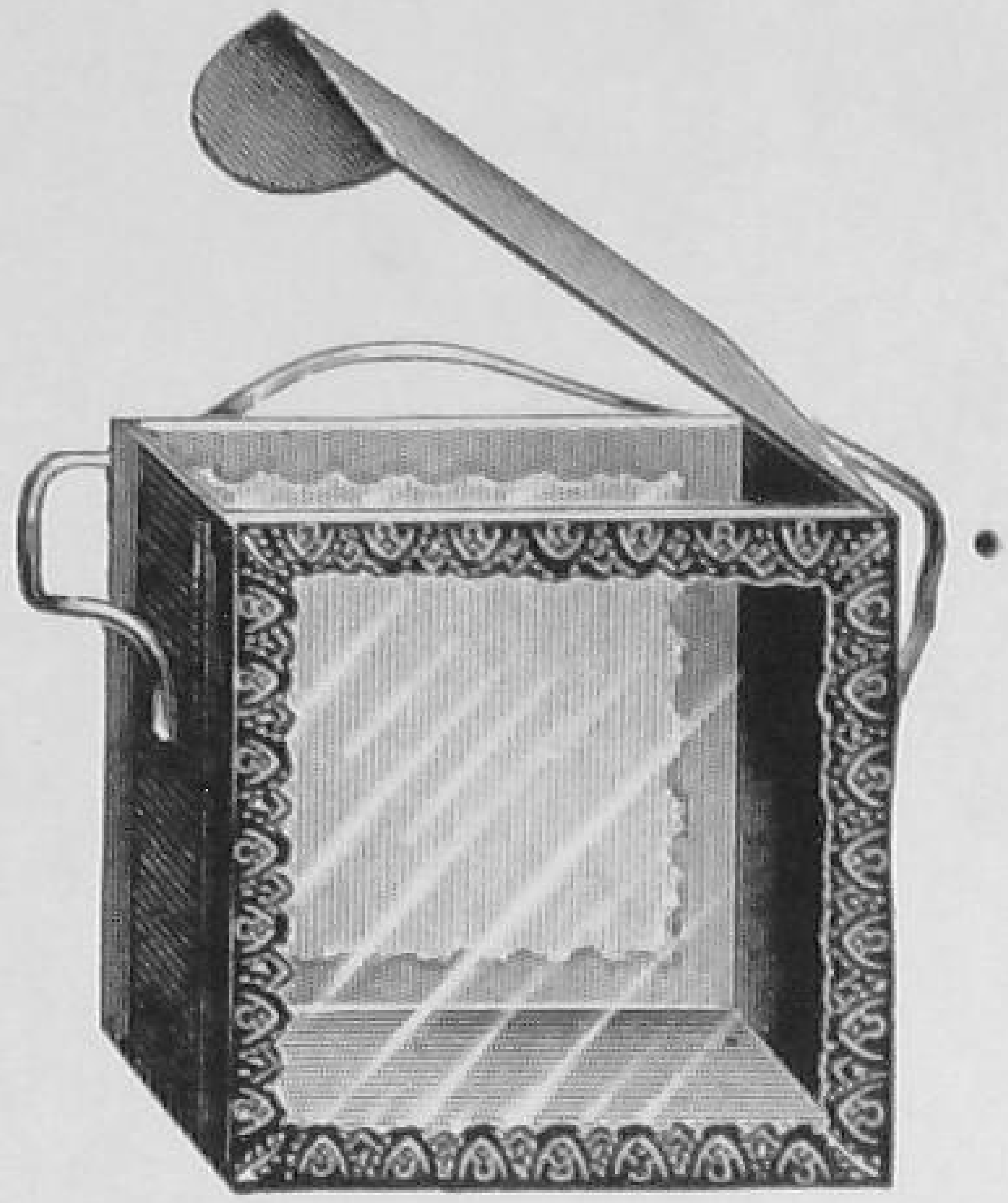


Fig. 72.—Lee's Section-case.

It is a pity that more honey-producers in this country do not put up extracted honey in the highly-ornamented self-opening tins, holding from two to fourteen pounds, such as shown in Fig. 73. Similar cans are largely used in Canada and the United States, and are proof against leakage, as well as being ornamental, and preferable to consumers in every way. Tradesmen generally dislike stocking honey in glass jars because of the nuisance caused by leakage and breakage.

Fig. 73.—Jones Bros.' 14-lb. Decorated Honey-tin.

Many Associations provide special labels for attaching to the honey of members, thus guaranteeing its genuineness. The demand for British honey having, as stated, largely increased, it may now be seen in the windows of all respectable grocers. Bee-keepers should therefore have no difficulty in disposing of their honey. It is encouraging to the British bee-keeper to know that, notwithstanding the larger amount of honey obtained in the

United Kingdom and the large importations from abroad, the demand for British honey is such that all of good quality produced in these islands will find a ready sale.

XVII.—ARTIFICIAL SWARMING.

It is known that bees on the point of swarming are frequently prevented from doing so by the state of the weather, and that sometimes they do not swarm at all. During all this time they are in an unsettled state, doing little, and wasting much valuable time. In view of this fact, and the uncertainties of natural swarming in our variable climate being so great, the surer and safer method of artificial swarming has been adopted by most advanced bee-keepers.

The saving of time is an important item in favour of artificial swarming, as with the movable-comb hive an artificial swarm can be made in a few minutes with a certainty of its doing well if the necessary conditions and rules are strictly observed.

As soon as a stock-hive is crowded with bees and contains drones, and honey is being collected abundantly, it may be swarmed artificially on a fine day. Do not wait to see if the bees are likely to swarm naturally and then do it, but make an artificial swarm at once, and so save time. Never delay until it is so late in the season that the bees will not have time to fill their hives with a strong population before winter.

To Make Two Colonies from One.—This is the simplest method, as it disturbs only one stock in carrying it out. Take a comb of brood and bees on

which the queen is found and place it into a hive, filling up the latter with empty combs or full sheets of foundation. Then place it on the stand where the stock stood, removing this to a new location. Cover up the hive, and all bees on the wing will return to the old stand, join the queen, and form the swarm. The old stock should have the frames brought close together, and an empty comb inserted at the side of the hive in place of the one taken out. This hive may have a laying queen introduced, or a ripe queen-cell may be given it on the second day after the operation.

To Make Three Colonies from Two.—This is also a very simple method, and is usually most successful. It is very advantageous for those who desire a large amount of honey with a moderate increase of colonies. It is impossible to get both a great quantity of honey and a large increase of swarms in the same season, except by great skill in management.

On a fine day, when most of the bees are flying, remove five frames containing brood and eggs from a strong colony, and shake or brush all the bees back into the hive; place these frames into a new hive, and fill up both hives with frames containing comb-foundation or empty comb; remove another strong stock to a new stand, and place the new hive where it stood. In this manner one colony furnishes the combs, while another supplies the bees, because those belonging to the hive removed to a new stand will return to the old spot and provide the new hive with the necessary population. These will at once commence queen-cells; but if we have a fertile queen to spare, she may be caged on one of the combs and liberated in thirty-six hours. (See "Introducing Queens," page 135.)

Another Method.—If the bee-keeper has five moderately strong colonies he may select four, take two combs from each, and brush all the bees back into their hives: insert two frames of comb-foundation in each hive to fill the vacancies, placing them near the middle, with a brood-frame between. Insert the combs removed into a new hive. Now remove a fifth strong stock to a new stand, and place the hive containing the combs in its place. The bees returning to their old stand will furnish sufficient population to protect the brood and raise a queen. If we can insert a fertile queen there is a gain of three weeks, and the careful bee-keeper will always have spare queens on hand for introduction when needed.

XVIII.—NUCLEUS SWARMING.

This is by far the best system of any yet described. The queen is matured and fertilised before the final swarming is performed; there are no queenless parts, and the labour of the hive is carried on with a rapidity only observable in hives where the presence of a young fertile queen inspires industry and prosperity; and honey is stored in sufficient quantity to repay the bee-keeper for the proper management bestowed upon them.

Examine one of the nucleus hives in which a queen has been reared (see "Queen-rearing," page 123), and if she has commenced laying, confine her in a queen-cage. Remove the division-boards, and fill up the hive with frames containing empty comb or comb-foundation. Now remove a strong stock to the stand occupied by the nucleus, and place the latter where the stock stood. This is important. Thus the bees

from the old stock, returning to their former stand, enter the nucleus, while those from the latter, and the young bees remaining in the old stock, will take care of the brood until increased in number by the rapidly-hatching bees. After thirty-six hours the queen in the nucleus may be liberated (see "Introducing Queens," page 135). On this method the bees should be swarmed in fine weather only, when a large number are flying; otherwise, if the nucleus appears deficient in numbers, it should be strengthened by inserting frames of capped brood taken out of the parent or other hives. If the queen is not caged we run the risk of losing her, because if the supply of forage has been temporarily checked, the bees returning to the hive will not be filled with honey, and would attack the queen and probably destroy her. If the nights are cold when the swarming has been done, the heat of the hive should be economised by only allowing the bees as many frames as they can crowd, contracting the space by division-boards. As soon as the combs are built out add empty combs gradually until the hive is filled. In this manner the bees only have to heat the space they occupy for work. Thus not only is a large amount of honey obtained, but it is frequently safe to make another swarm from the same hive. The desire to swarm naturally is checked, and all the difficulties experienced with other systems are overcome by a process so easy and gradual that a bee-keeper of intelligence can manage a large number of hives with both pleasure and profit.

SWARMS FOR SALE.—In making artificial swarms for sale, a sufficient quantity of bees are shaken from the combs into an empty hive, care being taken to secure the queen with them. The hive may then be placed for a short time on the stand occupied by the old stock until sufficient bees have joined the swarm.

The latter is then removed, and the old stock returned to its place.

Artificial swarms by any of the foregoing methods should only be made when stocks are very strong, honey abundant, weather fine, and drones present. Weak stocks should never be swarmed.

XIX.—SUBDUING AND HANDLING BEES.

Many persons would be glad to commence bee-keeping were it not for a natural dread of being stung. The stings of bees are given them as weapons of defence for the protection of their stores, and they are seldom disposed to use these weapons unless danger threatens. Bees under any circumstances cannot resist the temptation to fill themselves with liquid sweets, and with their honey-sacs full rarely sting unless hurt. They also, on being alarmed, immediately begin to fill themselves with honey from their combs. It will, therefore, be seen that to make bees harmless it is simply necessary to frighten them into gorging themselves with honey, when they may be handled with comparative impunity. This may be effected in various ways, one of which is to blow into the hive a few puffs of smoke. Brown paper, rags, old fustian, corduroy, or decayed wood answer the purpose; but care should be taken not to stupefy the bees by giving too much. A good bee-smoker is indispensable, and one of the best for this purpose is that known as the "Bingham" (Fig. 75). In it the fuel will burn for hours without going out if fed at intervals with the materials above described, and will eject a large volume of smoke to a distance of a couple of feet. After allowing the bees

a few seconds to fill themselves from their stores, the hive may be opened and a few puffs of smoke blown in under the quilt. If there is no honey in the hive with which the bees can fill themselves, on removing

Fig. 74.—Examining Combs in Frame-hive.

the quilt sprinkle them with a little very thin syrup before commencing operations.

Push the division-board on one side, to give room for moving frames laterally. Take hold of first frame

by the projecting shoulders in the way shown in Fig. 76, and carefully lift it out of the hive without crushing a bee. Raise it to the level of your face, as in illustration (Fig. 74) and examine it. When reversing comb to examine the other side, lower the right hand and raise the left until top bar of frame is perpendicular; now give the frame a half-turn round towards the right, lower the left hand and raise the right so as to bring the top bar to a horizontal position, as seen in Fig. 79, page 101. The four respective positions the comb takes are as shown in Fig. 77, and numbered 1, 2, 3, and 4. Care should be taken to keep the comb perpendicular, or it may, from its weight, fall out of the frame broken. With wired combs such accidents are, of course, not likely to happen. (See methods of wiring foundation, pages 73 to 76.) When both sides are examined, reverse the operation and bring the comb to its original position. It can now be hung on the comb-stand (Fig. 99, page 136), or on a portable rest made to hang suspended on the side of the hive (Fig. 78), and the other frames examined in like manner. In re-

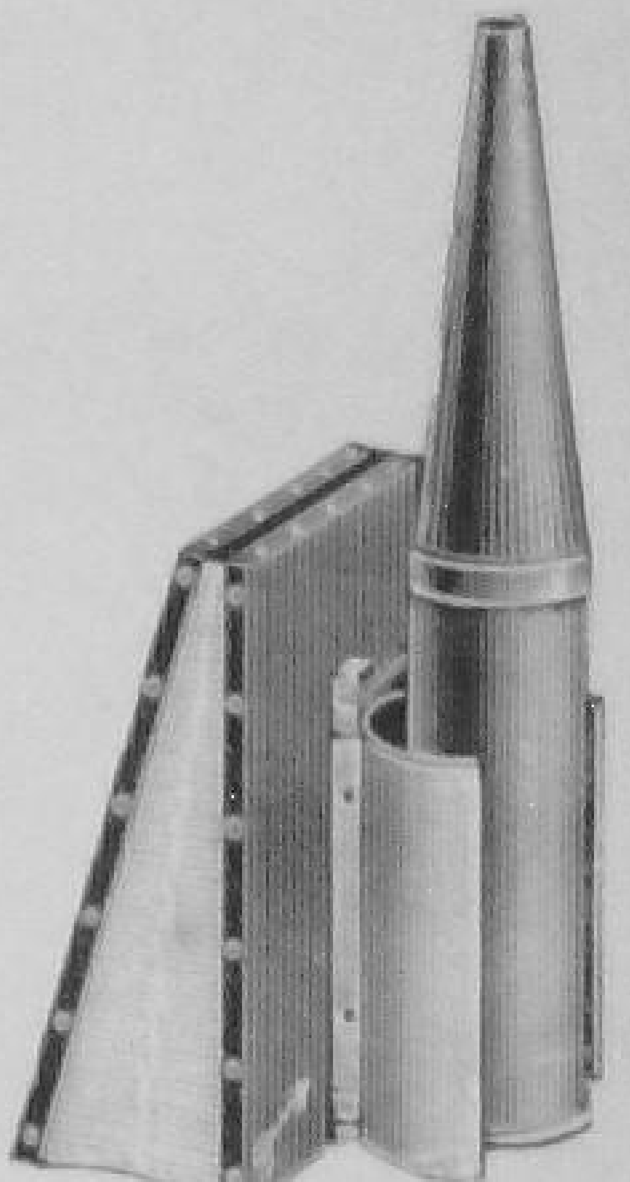


Fig. 75.—"Bingham" Smoker.

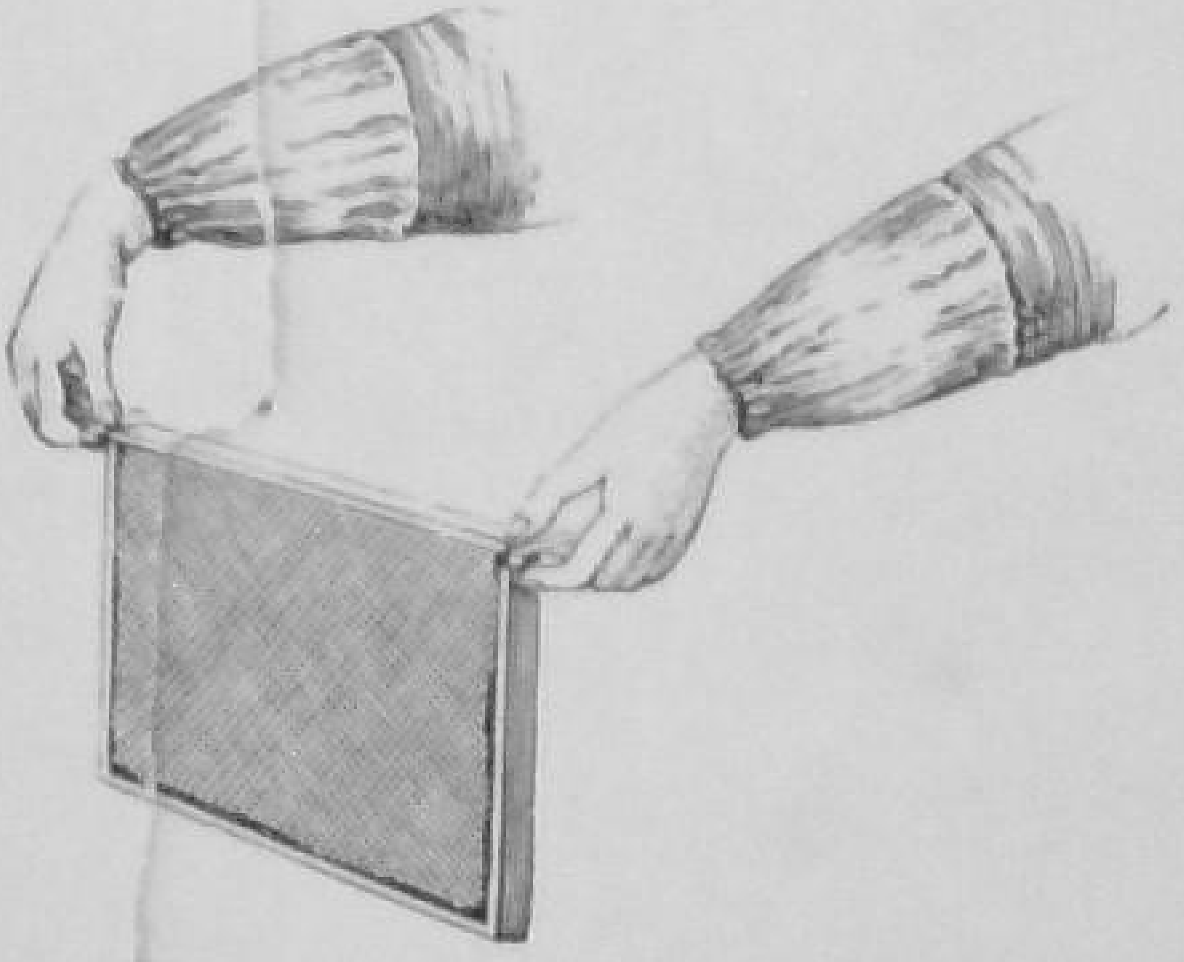


Fig 76.—Handling Frames.

placing frames, do it slowly, so as to allow any bee upon feeling the slightest pressure to creep from under them before it is hurt. When the frames and division-board have been returned to their proper places, blow a little smoke on the top, and replace quilts, one layer at a time, so that the bees may get away amongst the combs. During the examination give the bees more smoke occasionally to keep them under subjection.

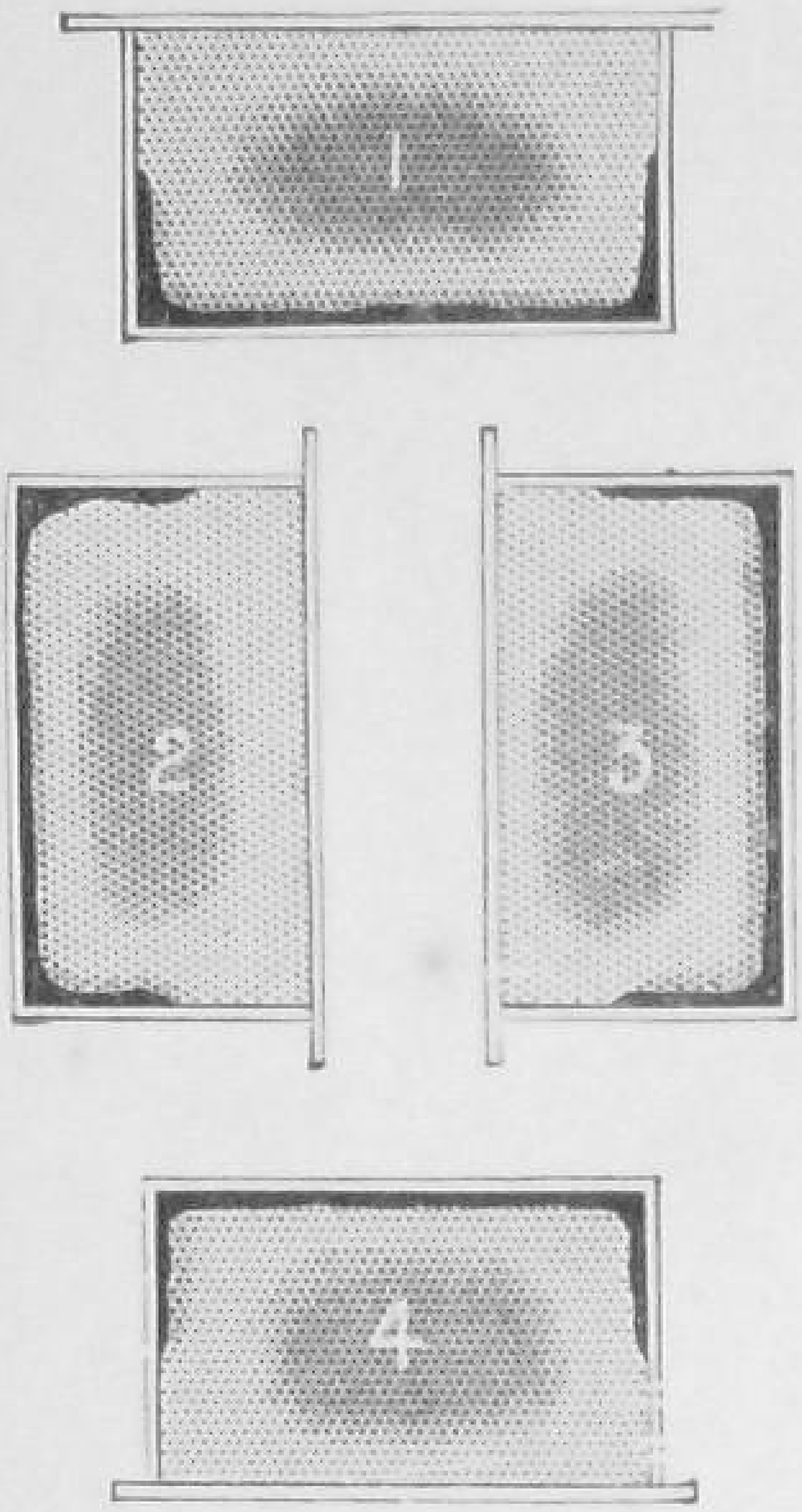


Fig. 77.—Positions taken in Turning Comb.

When using the smoker it is placed on end, as in Fig. 74. The tube, acting as a chimney, causes sufficient draught to keep the fuel smouldering. When done with, it is laid horizontally, the nozzle stopped with a wooden plug or cork, and it then goes out.

Carbolic acid, introduced by the late Rev. G. Raynor, is, from its easy application, frequently used. It has its advantages as a bee-quieter, causing less

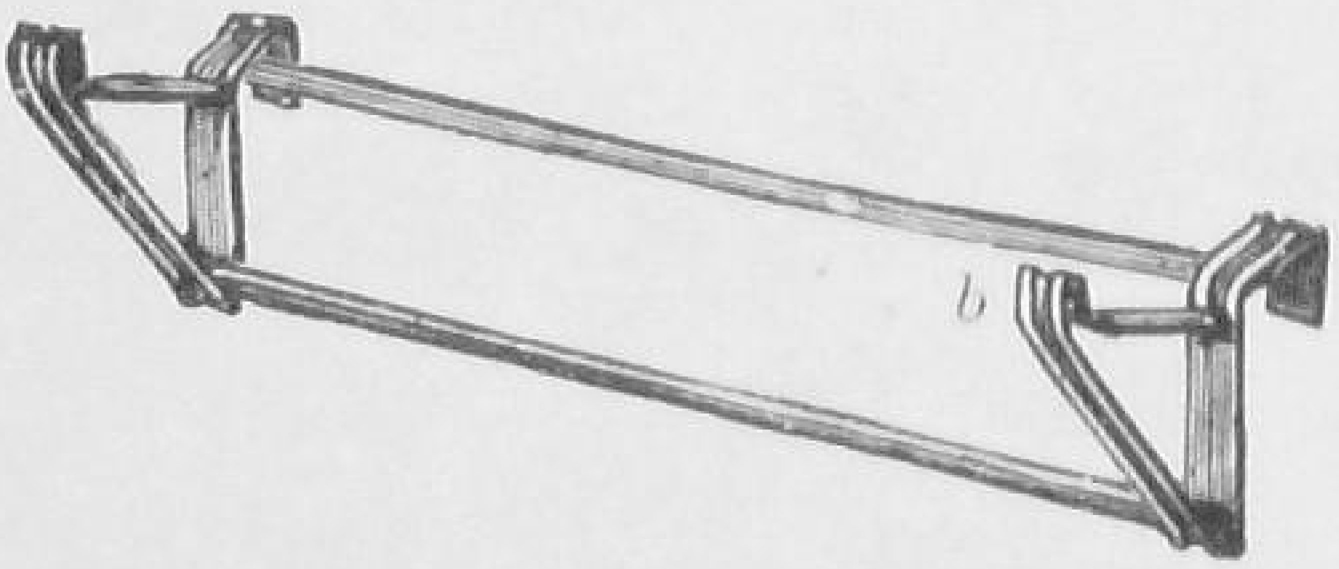


Fig. 78.—Portable Frame-holder for Hive-side.

disturbance than smoke, and is equally effective. It is also a powerful disinfectant and preventive of foul brood. Being a most powerful poison, and easily blistering the skin, extreme care is required when dealing with it, in the following way:—Put 1 oz. of

Fig. 79.—Examining Combs: Bottom-bar upward.

Calvert's No. 5 carbolic acid and 2 oz. of water into a medicine bottle. Into this fit a cork with a groove cut lengthways along the side so that after the bottle is shaken and inverted the contents will come out in drops. Cut a piece of calico to cover the hive

(18 inches square), sprinkle it with the solution, just to damp it, roll it up, place in a tin, and keep covered until wanted for use. When about to examine bees, gently strip off the quilt and at the same time pull the carbolic cloth over the frames. After a few seconds the bees will go down, and the cloth can be folded back while the combs are examined. Should the bees come up and appear troublesome, draw the cloth over the frames again. Never obstruct the bees' flight when manipulating hives; stand in rear of the entrance (see next page).

Bees may be easily removed from the frames by shaking them off the combs. Only strong combs, however, admit of this treatment. Take hold of projecting ends of the frame and hold the latter in a perpendicular position (see page 98); now bring it down with both hands quickly, and when within a couple of inches of the top of the hive stop suddenly. This jerk precipitates the bees into the hive. Combs containing queen-cells should never be shaken in this way, as the royal occupants are likely to become injured by so doing.

Bees may also be easily brushed off the combs with a light dusting-brush; a feather from a goose-wing is very useful for this purpose. Take care to brush combs from the top downwards, as most of the bees will have their heads turned towards the top of the frames, and if brushed any other way they become very much irritated, and dart at, and endeavour to sting, both the brush and the hands of the operator.

As a rule, bees never use their stings except in self-defence, therefore in all operations it is necessary to proceed cautiously and quietly, and to take great care never to crush a bee. A bee-veil (Fig. 80), to protect the face, and indiarubber or thick woollen gloves on the hands, will often give the bee-keeper confidence;

Mr. W. Broughton Carr ("W.B.C.") Examining a Candidate for the B.B.K.A. Expert's Certificate.

but gloves will soon be dispensed with as clumsy in performing delicate operations. When honey is plentiful, bees in full work, and the bee-keeper has gained courage and experience, the veil will be less frequently used. The veil should be made of coarse black net, 1 yard by 18 inches being sufficient. Fasten the ends together, run a hem round the top, insert an elastic, and draw it up until it fits round the crown of a hat. The rim of the hat keeps the veil from the face, and the lower end can be tucked in under the coat about the neck. Those who are afraid of having their hands stung should rub on them a little of "Grimshaw's Apifuge."

Fig. 80.—Bee-veil.

Gauntlets (shown in Fig. 76) are useful in preventing bees getting up the sleeves when manipulating. These are easily made of calico, and have an elastic band at each end.

By improper management, such as jarring the combs, brushing bees off them the wrong way, or quick motions, they are excited to anger; human breath, too, is often offensive to them. The smell of their poison also, arising from a crushed bee or from the sting inflicted in the clothing of the bee-keeper, irritates them. If stung, remove the sting as quickly as possible with the point of a pen-knife, and avoid any rubbing, as by this means the poison is diffused. Various remedies have been recommended, but in many instances they are worse than the sting, and as no two constitutions are alike, what will alleviate the pain in one case very often produces a

contrary effect in another. Tobacco, moistened and rubbed on the affected part, a little honey, or "Apifuge" also stops the irritation. While some persons suffer more from the stings of bees than others, those who have been stung a number of times feel little or no pain.

XX.—UNITING.

A large cluster of bees is able to maintain the proper degree of warmth in cold weather better than when divided into two or more small clusters, and the consumption of food is less. If weak colonies are found in the apiary, they should, if healthy, be strengthened by helping them with comb, brood, or honey taken from healthy, strong colonies which can spare it, or two of them may be joined together.

Established colonies in movable-comb hives can be united without removing the bees from the combs. Bring the hives close to each other (see page 120), and induce the bees to fill themselves with honey from their stores by any of the methods recommended (see page 97). Open the hives, and after dusting the bees of both stocks with flour from a dredger, place the combs—with the adhering bees—alternately into one hive, spacing them rather wide apart, so that the bees cannot touch each other. Next day the frames may be closed up to their ordinary spacing. If there are more combs than one hive can receive, insert those containing brood in the centre, and fill up the hive with combs containing honey. Should there be any choice of queens, remove the inferior one. Cover them over, and all the bees will generally unite peaceably.

Uniting Swarms.

Swarms issuing the same day may be united by shaking them together on a sheet; or, if one has already been hived, in the evening shake out the swarm from the hiving-skep on to a sheet in front of the hive containing the first swarm to which it is desired to unite it, as shown on opposite page.

Another way is to make an artificial swarm of all the bees in the queenless stock by brushing them off the combs into an empty hive. Dust the other stock with flour, set the hive on a sheet, and raise its front edge. The queenless bees may now be dusted in the same way and shaken on the sheet in front of the stock-hive, which they will readily enter. If it is desired to join a swarm to a full stock we may proceed in the same manner, except that one of the queens must be removed to prevent their fighting. If we wish to retain the queen in the stock-hive, while the bees from the swarm are entering the hive, look for the queen, and if seen she must be taken away; for if allowed to enter, a combat will ensue between the queens, and if the one in the stock be fertile she usually falls a victim, and the bee-keeper thus runs the risk of losing the other queen, if not yet fertilised (which would be the case with after-swarms), while out to meet the drones.

In all operations connected with uniting, the bees should be thoroughly dusted with common flour used from a dredger. It is by far the quickest method of uniting, and has the advantage of not inducing robbing as syrup does; in fact, the bees are too much occupied in removing the flour from their own bodies to think of quarrelling.

When uniting driven bees to an established stock, great care is needed to prevent fighting. The danger may, however, be minimised by placing an empty hive by the stock, from which remove half the combs,

and, after jerking off the bees and allowing them to run back into their hive, put the beeless combs into the empty hive, spacing the frames wide apart and covering them with a single quilt. Then dust the bees of the stock with flour, close up the frames, and replace the quilts for a time. Next throw out the driven bees in front of the empty hive, and dust them with flour as they run in. When they have taken possession of the combs, space the latter wide enough apart to allow of their being alternated with those of the stock-hive, which, with their adhering bees, are again dusted and placed along with the driven bees, and both lots unite quite peaceably.

XXI.—FEEDERS AND FEEDING.

The time and method of feeding, as well as the food employed, vary according to the object the bee-keeper may have in view. In spring and summer bees are fed for the purpose of stimulating and preserving. Some bee-keepers consider it superfluous to feed when there are sufficient stores within the hive, and tell us that Nature prompts the bees to use honey as they need it. This is true, and under such circumstances their development is sufficiently rapid for their own preservation, and they may be able to lay up for themselves a sufficient store for their own use; but the object of the bee-keeper is to ensure beyond this a large surplus, which he may appropriate to himself. To secure this he must stimulate to activity early in the season, and the cost of the food employed at this time will be repaid by greatly increasing the honey-

harvest. The great secret of successful bee-keeping lies in having strong colonies always ready to gather surplus whenever a good honey-flow comes. When bees are bringing in honey and pollen for feeding the brood, the queens commence laying rapidly. It sometimes happens that in early spring and summer the supply of honey left over winter is quickly consumed in raising young bees. The early flowers furnish honey and encourage this development; but when this first pasturage fails, there is perhaps very little honey in the hive and much maturing brood. A little gentle feeding will keep such a colony prosperous, in default of which it might be thrown back in its development in a few days more than it could regain in as many weeks; because, when a colony rapidly rearing brood finds that honey is scarce both within and without, the queen stops laying and the bees destroy the larvæ and eggs.

Too much stress cannot be laid upon this, for it is a lamentable fact that hundreds of strong, prospering colonies perish every year for want of timely attention with regard to the store in the hive. Inexperienced bee-keepers cannot realise that there can be any risk in leaving alone a stock that is prospering outwardly, yet in a few days it may be dead from starvation.

Spring Feeding.—The object of feeding in spring is either to induce breeding or to preserve the lives of the bees when stores are running short, or both. Rapid development may be encouraged in spring, if honey is plentiful in the hive, by uncapping or bruising some of the sealed cells every few days with a knife, and allowing the bees to help themselves as they require it.

Should they be short of food in the hive, and the bee-keeper wish to get full advantage in stimulating

brood-rearing early in the season, he must commence about the end of March, or when the bees fly freely, to supply liquid food (see Recipe No. 5, page 197), and regulate his feeder in such a way that only a small amount of food can be taken down at a time. One of the simplest feeders for the purpose is the bottle-feeder (Fig. 81). In this the stage is a square piece of wood having a hole in the centre, over which is placed the feeding-bottle with its mouth covered with thick twilled calico. A piece of tin is inserted below the mouth of the bottle when removing the latter for refilling to prevent the bees from escaping.

Fig. 81.—Bottle-feeder.

Soft candy (page 195), placed under the quilt on top of frames over the cluster, may be used instead of syrup if the weather be very cold and bees not inclined to take liquid food.

A very convenient feeder, introduced by the Rev. G. Raynor, and which avoids many objections to this form of feeder, is shown in Fig. 82. The bottle, which holds about a pint and a half, is fitted with a screw metal cap, coated inside with cork, so that when screwed on tight no leakage can by any possibility take place. The cap has a semi-circular piercing of twelve small punctures, corresponding with a slit in the stand or "stage," $\frac{1}{8}$th of an inch wide, and an index finger for regulating the supply, rendering the feeder available for gentle stimulation, or copious feeding

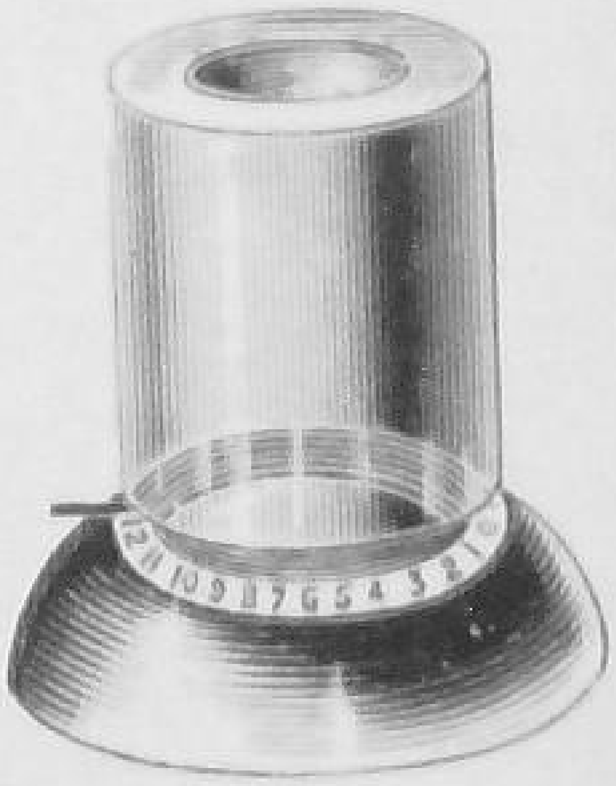


Fig. 82.—"Raynor" Regulating Feeder.

when all the holes are turned on. The feeding-stage is dome-shaped, and the under side is lined with cloth, which renders it impervious to moisture and non-conductive of heat; its diameter is 6½ inches, depth 1½ inches, and admitting the bees from five frames. The stand shown in Fig. 82, besides being dome-shaped, is provided with a projection in the centre to which the bees extend the cluster from the combs beneath. It is entirely of wood, and the bees come into contact with no metal. The advantages are that, when placed on the frames, over the centre of the cluster of bees, the heat, ascending, renders the interior of the dome the warmest part of the hive, and the bees can feed in the coldest weather, when unable to extend themselves laterally over the combs.

The bee-keeper is cautioned against using beet-sugar for syrup, as being injurious to bees, especially as winter food. Pure cane-sugar (refined) is wholesome, and, being sweeter, is more economical. Raw or moist sugars are unsuitable for syrup-making, often causing dysentery in bees.

Sometimes what is known as "Scholtz candy," or, as it is commonly called, "Good's candy," is used. It is made by mixing together liquid honey and finely-powdered loaf-sugar until the consistency of dough or stiff putty is reached. Lay the paste on the frames over the cluster, and cover with the quilt.

SUMMER FEEDING.—Swarms, unless they have partially-filled sections on them, should always be fed, more especially if the weather be cold and rainy, giving them not more than half a pint of syrup a day; whenever there is a check in the flow of honey, and the bees are short of food, it should be given to them. In many places bees do little between the time the

fruit trees have done blooming and the time clover appears, and again from the end of clover-bloom to middle of August. If they are fed and kept strong at these times they will not fail to repay the loan with interest, and enable the bee-keeper to secure a larger harvest than he otherwise would do. At such times it is better to feed with diluted honey, or the thin extracted honey that floats on the top of the ripening-can (Fig. 67), because if we use the extractor we then run no risk of having syrup stored instead of honey.

At the close of the honey harvest it is frequently advantageous to resort to "stimulative feeding," the object being to raise young bees. The food should be given slowly and regularly to the amount of a quarter of a pint every evening. By this means the queen is encouraged in egg-laying, resulting in the raising of a large number of young bees. These will keep the stock strong until those hatched in the spring take their place.

Autumn Feeding.—This should be commenced not later than the middle of September. If, after the honey harvest, we have kept the bees breeding by stimulative feeding, it should be discontinued now, and the stocks fed up as rapidly as possible every night with warm syrup of a thicker consistency than that used for stimulative feeding (see Recipe No. 6, page 197).

Fig. 83 shows a rapid feeder used for this purpose, which holds from 10 to 20 lbs. of syrup.

When our hives contain about 30 lbs. of stores, feeding must be discontinued (see "Wintering," page 190).

Each hive, as a rule, should have about three superficial feet of sealed honey, which—along with the unsealed stores—will last the bees well through the

winter and early spring. The bee-keeper may judge approximately by having the two outer combs well filled and sealed, and six other frames about half-filled with sealed stores.

Winter Feeding. — When supplies run short in winter soft candy should be given. This can be placed on the top of the frames under the quilt, and the bees will consume it as fast as they need it (see Recipe No. 2, page 195), or frames prepared and filled

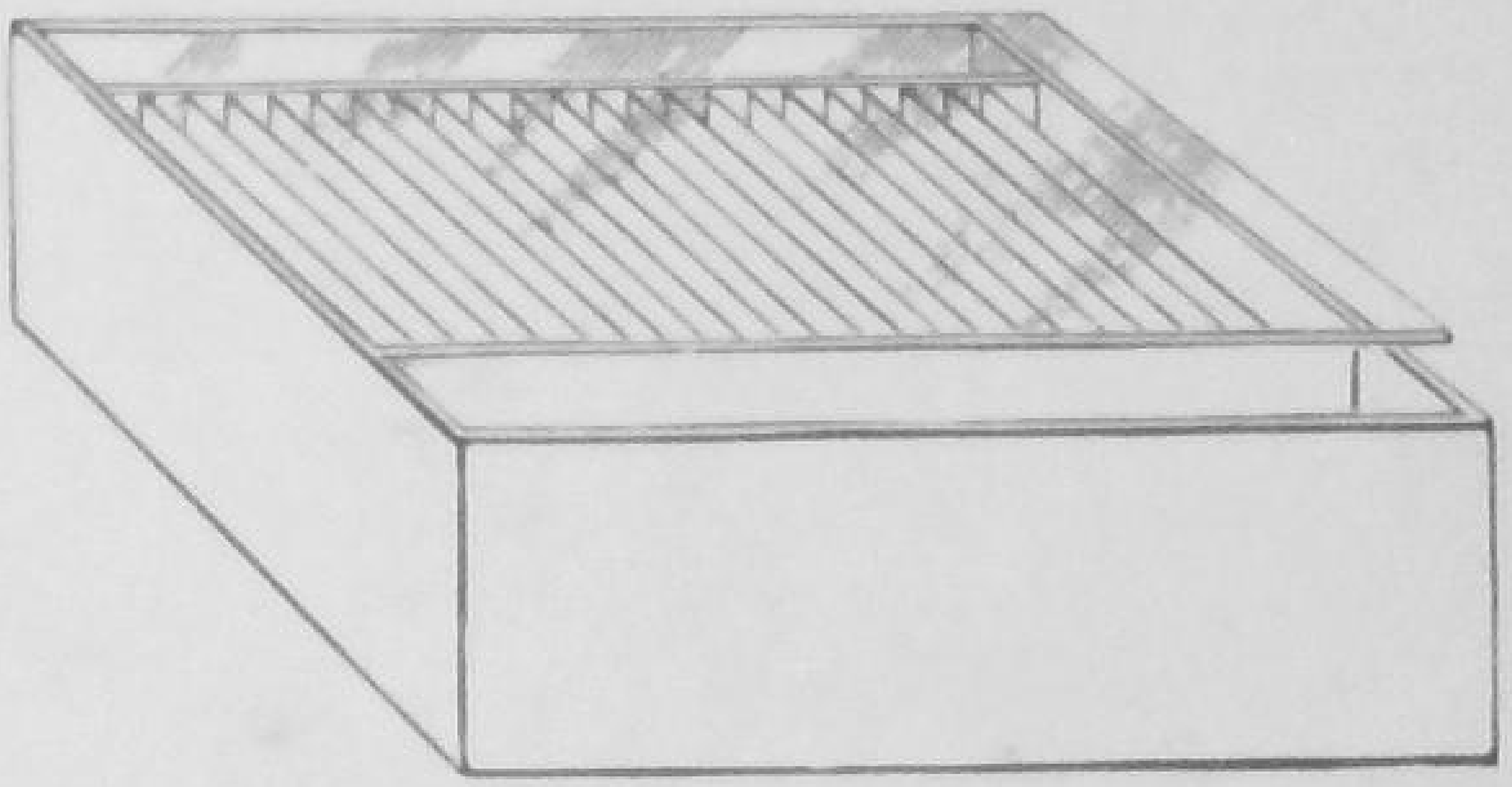


Fig. 83.—Rapid Feeder.

with candy may be inserted in the hive, at the sides of the cluster.

Feeding to Produce Combs.—At times when forage is scarce bees may be profitably employed in drawing out comb-foundation. Frames filled with full sheets are placed in the centre of the brood-nest, and by gentle feeding the bees work them out; and if no eggs are deposited in them they can be removed. If, however, breeding has been already commenced, remove the outside combs or those containing no brood, and store them away for future use. Empty combs are always useful, and a large supply of these should always be on hand when working for extracted honey

on the storifying principle. Empty combs supplied to swarms give them several days' advantage over those not thus provided. Some drone as well as worker combs should be worked out, as these may be wanted for rearing drones.

Another Plan of Rapid Feeding.—Instead of feeding each hive separately, and keeping all the colonies in commotion, the idea occurred to me that one hive might be made to store syrup for all the hives in the apiary. For this purpose I had a paraffin stove fitted so that one hive could be kept at a high temperature day and night. The feeder (Fig. 83), holding about half a gallon of warm syrup, is placed on the top of the hive, and replenished as fast as the bees take the syrup down. In this way they very quickly fill and seal their combs from top to bottom. As fast as the combs are completed they are removed and distributed amongst those hives requiring stores, giving the hive empty combs to fill. By adopting this method a large number of combs may be filled and sealed in a very short time. The stove may be dispensed with if one stock is fed up rapidly, commencing in September.

Pollen.—Besides syrup, pollen is required in rearing young bees. As soon as the bees begin to fly in spring, if they do not gather pollen in abundance naturally, they should be furnished with it. Pea, lentil, and wheat flour or oatmeal will answer the purpose. This should be placed in a sunny corner sheltered from the wind. Chaff or sawdust mixed with it will enable the bees to gather it better, as it gives a foothold, and prevents them from being smothered in the flour. If an old used skep is available, smelling strongly of propolis, and slightly

warmed before putting in the chaff, it is an irresistible attraction to the bees when used for this purpose. A little piece of comb containing honey placed on the flour will also attract the bees. Artificial pollen should be supplied so long as they will take it. When natural pollen is abundant the artificial substitute is disregarded.

Water.—Bees need water constantly. If there is no natural supply in the vicinity of the apiary we can give them what they want by filling a glass jar with water and inverting it on a plate, so that a small amount of liquid escapes round the mouth, and the bees will help themselves to what they require without any danger of being drowned. A teaspoonful of salt can be added to every pint of water.

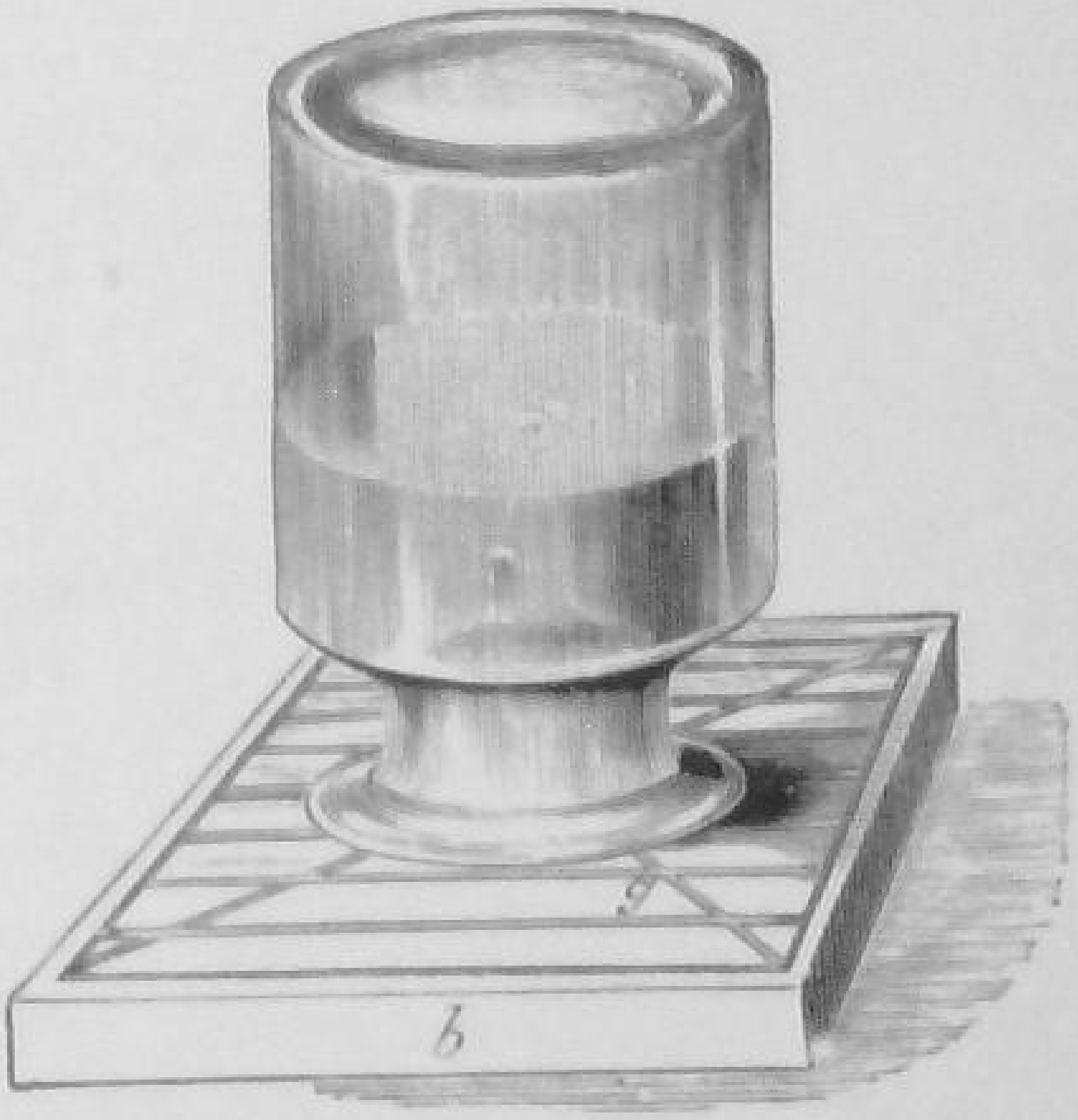


Fig. 84.—Bottle-fountain.

Another plan is to have a bottle-fountain (Fig. 84). In this the stage consists of a board in which grooves are cut, as shown. The bottle is inverted and filled, and the stage being placed over it, the two are turned over. The water fills the grooves as rapidly as the bees carry it off.

Among extemporised "watering-places" may be named:—(1) A small barrel with a tiny hole bored in its lower edge, which allows a constant drip to fall on to an inclined board reared up to receive it. (2) An open water-tub, in which cut corks form good

resting-places for the bees. (3) Spent tea-leaves, kept moist, as needed.

CAUTION!—One general caution is necessary in feeding. Always contract the hive entrance, and make quite sure that no bees can get at the food-bottle from the *outside*. Should the roof or other movable parts of the hive not be perfectly bee-tight, the bottle must have its lower edge wrapped round with a roll of such material as will keep robber-bees from reaching the syrup from outside (see "Robbing," page 162). A tin, if available, can be placed on the stage over the food-bottle, and will exclude all robbers.

XXII.—MOVING BEES.

When either newly-hived swarms or stocks are placed on the stands, the bees, on leaving the hive, mark the locality. If, therefore, it becomes necessary to remove stocks at a time of the year when the bees are flying, they must be taken a distance of two miles or more, otherwise many of them will return to their old stands, and be lost.

PACKING BEES FOR TRANSIT. — When preparing stocks of bees for travelling long distances by rail or otherwise, much care is necessary in order to save them from damage at the hands of porters or others unaccustomed to handle such things. If in skeps the contrivance (Fig. 85) will be found effective for securing safety in transit. It consists of two strong wooden frames crossed, the sides projecting as seen. To one pair of these a bar is fixed which forms a handle for carrying. When the bees are secured in

the skep, they should be covered with a coarse net or cheese-cloth, stretching tightly, and securely tied. The frame is inverted, and stands on the projecting pieces, which now act as feet. The bottom cross-bars (now at the top) are removed, and the skep inserted mouth downwards. These bars are then

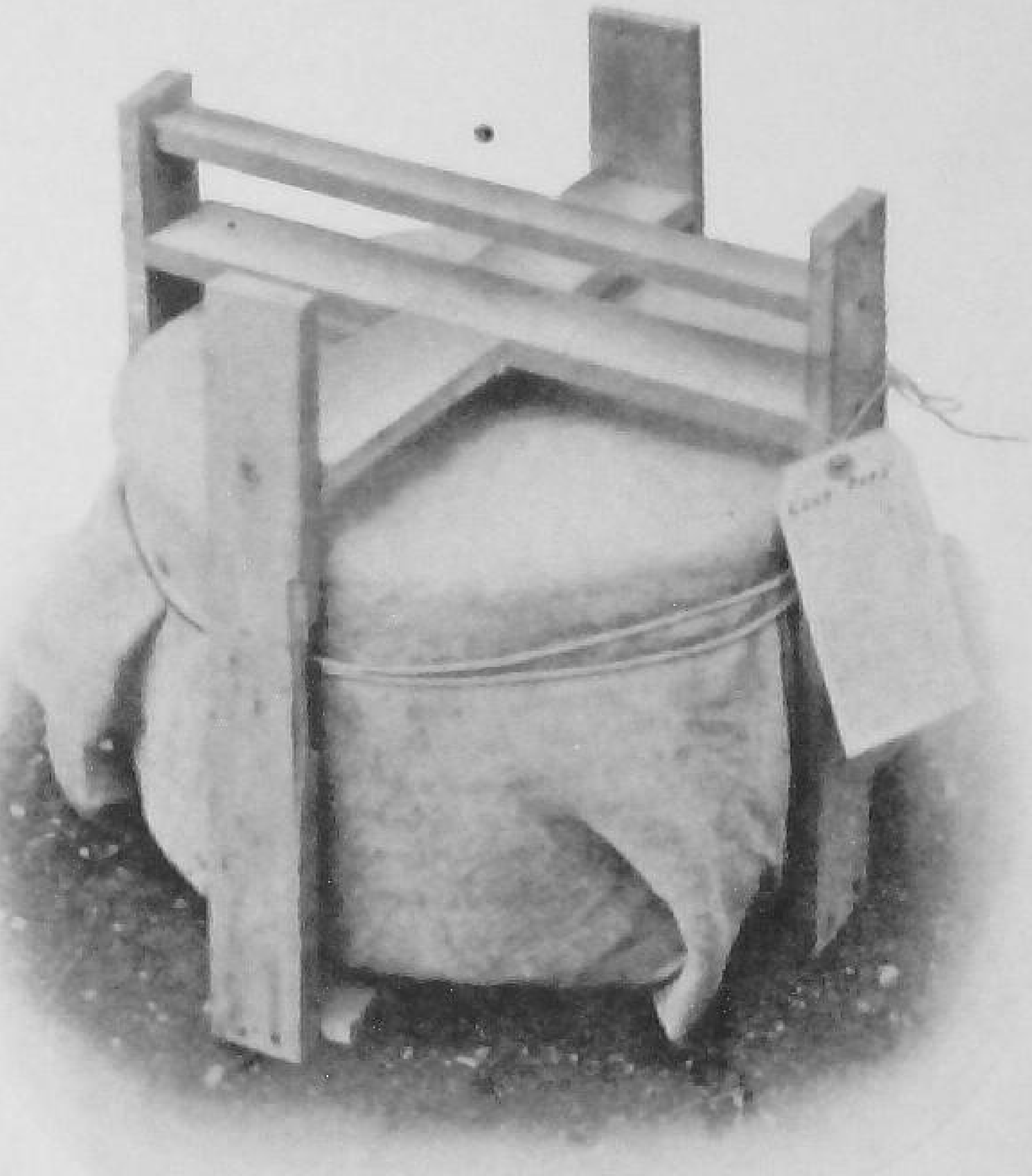


Fig. 85.—The "Herrod" Skep-carrier, for Safe Travelling by Rail.

replaced, the whole turned over, and with a label, "Live Bees with Care," attached, is ready for the journey, and, with ordinary usage, would be safe. There are, of course, times and conditions when only an experienced person can judge whether or not it is safe to send bees by rail

Stocks in frame-hives can be made more safe in transit because of the facility for giving ventilation *above* and *below*. With tough combs in weather not too hot for travelling in, all will go safely for long distances by packing as follows:—Supposing the

Fig. 86.—Packing Bees in Frame-hive. Giving Bee-space above Frames.

frames to have metal ends or broad-shoulders, and are properly wired, a stout frame made of wood $1\frac{1}{4}$ inches square (Fig. 86), the longer sides being the same length as top-bars, and the cross-pieces placed so as to rest on the metal ends or broad-shoulders, will,

when screwed down at the projecting ends, keep the frames rigid. When covered with perforated zinc, or with strong, coarse net, this frame allows free expansion space for the bees to pass from frame to frame, and prevents risk of suffocation when travelling. Additional air-space may also be obtained by using an eke 3 inches deep, lifting the hive on to it,

Fig. 87.—Frame-hive Packed for Transit.

and screwing all down securely to floor-board by means of a couple of angle-plates.

A piece of perforated zinc made fast over the entrance completes the packing; but if the journey be an especially trying one, and in hot weather, a hole 4 inches square may be cut in the floor-board, and a piece of perforated metal nailed on its upper side.

When the body-hive has been made secure to the

floor-board, so that no bees can possibly escape, the outer cases and roof are put on, and the whole bound together with stout cord, as shown in Fig. 87.

In sending stocks by rail they should have old and tough combs, as new combs are too brittle to travel with safety.

Swarms, if coming from another apiary, should be moved in the evening of the day on which they issue. In this case, if conveyed by hand, the skeps, being combless, may be carried bottom downwards.

Arrived at their destination, the hives should be at once placed where they are to stand for the season, and the bees allowed to fly, all packings being carefully removed next day, and a quilt put over the top of frames.

If stocks have to be moved but a short distance, or to a different part of the apiary, as in bringing together for "uniting," they should not be moved more than two or three feet each day, not reckoning those on which bees are not flying.

XXIII.—LOSS OF QUEENS.

The loss of the queen-bee often occurs through accident or deformity, and unless remedied in time, the entire colony perishes. In the act of swarming, too, the queen is sometimes lost through some accidental injury to her wings subsequent to her first flight. In such a case she falls to the ground, perhaps into grass, and if the bees are unable to find her, she is usually lost, as although they may cluster on some branch for a few minutes, they will eventually return to the parent hive. Young queens are not seldom lost while out to meet the drones, while some

are born with wings so imperfect that they cannot return to the hives; others are caught in the air by birds. The larger number are, however, lost in attempting to return to their hives. Although a young queen, when starting forth on her marital flight, endeavours to mark well the spot on which her hive stands by flying with head towards it for several minutes before rising high into the air, yet sometimes, on returning, she misses her mark and attempts to enter the wrong hive, and is at once seized and killed by the workers guarding the entrance. This risk is increased when the hives are alike, of equal size, shape, and colour, crowded close together, and all facing in one direction.

Losses from this cause may be minimised by painting the front of the hives different colours. A queen lost in this manner from a second or after swarm, or from a swarmed stock, is a serious loss, as the brood is too far advanced to raise a queen, while after-swarms are, of course, broodless.

The workers soon give evidence of the loss of their queen. They rush from one part of the hive to another, in and out, and up and down outside, the commotion continuing for about three days, usually in the morning when other colonies are quiet. They then settle down quietly, and sometimes begin to work; but a dissatisfied appearance is noticeable; when returning home, instead of entering in haste, as usual, they linger on the alighting-board, as if undecided whether to enter or not. Drones are tolerated while other colonies have killed or excluded them; the population is reduced by continual losses, and if not re-queened, the colony dwindles away, and eventually dies out.

Colonies that have swarmed, and all after-swarms, should be occasionally examined until the safe mating

of the young queen is assured by the presence of eggs and brood. Failing which, steps should be at once taken to either introduce a queen (see "Introducing Queens," page 135), give a queen-cell, or a comb of brood containing worker-eggs or very young larvæ, from which the bees can raise a queen. If the colony is too weak to do this unite it with another stock (see "Uniting," page 105).

Queens are occasionally crushed by carelessly raising frames without first spacing the combs apart to get the necessary room for lifting them out easily. In hives badly protected in winter cases occur where —without any harm happening to the bees—the queen becomes chilled, so as to destroy her fertility. Queens will also become unfertile if subjected to partial starvation for want of food. In the latter case the colony, though not queenless, gradually dwindles away—through no brood being raised—and is eventually lost.

By untimely manipulation, especially in spring, or when young queens have just begun to lay, or have failed to become fertilised within reasonable time, a queen may be attacked by the workers and hugged to death. This is called "balling," and should be carefully guarded against by not manipulating hives unnecessarily. When balling takes place the queen should be freed from the bees by the application of a few puffs of smoke, or if this fails, the ball can be dropped into water, and the queen caged on a partially-filled comb for a couple of days.

Queens also die of old age, when from four to five years old. When the fertility of the queen begins to fail, the workers usually supersede her by raising another; yet, if her loss should occur at a time when no brood is found in the hive, or there are no drones to impregnate the young queen—should they succeed in raising one—the colony will become queenless, or

the unimpregnated queen a drone-breeder. In this case the queen is removed, and her place supplied with a young fertile one.

If the loss of the queen is detected in early spring, or late in the autumn, when no drones are present and a fertile queen is not available, unite the bees to another colony, for it would be useless giving brood to rear a queen under the circumstances named.

The careful bee-keeper will never allow queens to become old, but remove them after the second season, introducing instead young fertile ones. Occasionally, when a hive loses its queen, a fertile worker will lay eggs which only produce drones (see page 13). The most effective way to get rid of a fertile worker is to break up the colony, dividing it among strong colonies having fertile queens. If a stock of bees in spring does not carry in large quantities of pollen while other colonies are very industrious, queenlessness may reasonably be suspected; no time should therefore be lost in examining the hive. A stock of bees retaining its drones alive in winter may also be noted as queenless.

XXIV.—QUEEN-REARING.

The practical bee-keeper will never allow any hives to be without a fertile and prolific queen, as the successful management of bees depends upon having every colony strong. A period of nearly three weeks generally elapses before eggs can be laid (except by a fertile worker), when a hive swarms or loses its queen, and as the mortality among bees during the summer months is very great, the colony rapidly declines in numbers. But if a fertile queen be given to a queen-

less colony, no time is lost, and the population is kept up in sufficient numbers to ensure its prosperity. To secure the best results it is therefore advisable always to have on hand a supply of fertile queens to meet contingencies.

Some queens, too, through old age or other causes, are not so prolific as we could wish, or are, perhaps, deficient in the good points possessed by others. All inferior queens should, therefore, be removed and replaced by selected ones chosen for their good qualities from those on hand. Remember that success in honey-getting will be in direct ratio to the vigour and capacity of our queen and the hardiness and number of her offspring.

We should endeavour to perpetuate the distinguishing characteristics of desirable stocks; therefore in selecting mothers for future queens choose such as are two summers old and have been prolific, and whose worker progeny were hardy, vigorous, and industrious. Bear in mind also that, as a general rule, queens transmit working qualities and constitution, while disposition comes from the drone.

Young queens are, as farmers say, "in full profit" the second season, and should not be kept longer unless their qualities are such as to make it desirable to perpetuate them, the object in view being the improvement of the race. Preparation must be made for commencing queen-rearing early in the spring. Select your best colony, and make it strong by stimulative feeding. This hive should be furnished with worker-combs and kept for raising queens only. For drone-raising another equally good colony must be chosen, and stimulated early; when strong enough, introduce drone-comb into the centre of brood-nest, and by feeding more rapidly the queen fills these cells with eggs,

which in due course produce drones, ready to fly by the time they are required for fertilising queens.

In this way, by a judicious selection of stocks, we not only prevent that close in-breeding which results if queens and drones are raised in the same hive, but

Fig. 88.—Bees Subdued after "Driving."

improve our race of bees by perpetuating the good qualities of our best stocks.

If we have induced early breeding, drones should be hatching out in April; when this is found to be the case, place a frame of clean worker-comb in the centre of brood-nest of the other hive being stimulated, and

this comb the queen will fill with eggs. Three days afterwards the queen may be removed and utilised elsewhere. All combs containing unsealed larvæ should also be removed and given to other colonies.

The bees will now commence queen-cells, and we can assist them by enlarging the mouth of any particular cell we wish them to start upon with a piece of wood in the shape of a cone, in such a way as to break down the walls of the adjoining cells, especially those beneath. It is advisable to get queen-cells built on the edges of the comb, so that they will hang down and be easily removed; the comb is, therefore, cut away close up to the cells desired for queens. Always endeavour to get queens raised from eggs and not from larvæ, as the former, having the advantage of abundant feeding from the first, produce the most desirable queens. If these directions are carried out, we shall have from ten to twenty queen-cells started under the most favourable conditions, and in eight to nine days from that time the bee-keeper will be ready to form his nuclei. The bees should be gathering both honey and pollen in quantity when the cells are started, and until they are capped over, otherwise they must be supplied with food artificially. If it should be thought requisite to raise any more queens, all queen-cells in this hive may be removed to form nuclei, and we can again supply eggs from the same queen, and thus we keep the same queenless colony raising queen-cells until we have as many as required. When all the queen-cells are removed, we can build up the stock by introducing a fertile queen and capped brood.

Another good plan of dealing with the stock selected for raising queens from is to take away the frame of eggs only, and raise the queens in another strong stock the queen of which is past her prime. By this

method the last-named colony is rendered queenless three or four days before the best queen's eggs are ready for removal, during which time queen-cells will be started, and all such must be removed. Then introduce the comb of eggs from the selected stock (after dealing with the cells chosen for queens as previously directed), and let the bees raise queens in them. About eight days later all cells except one are given to as many nucleus colonies as may be formed, and the stock made queenless is re-queened with a choice mother-bee from the best colony, without the latter being appreciably checked in its prosperity during the current season.

A word of caution is here needed regarding the care necessary when handling or manipulating combs on which queens are being reared. Such combs must not have bees removed from them in the usual manner by jerking downwards to dislodge them; such a movement might damage, or even kill, the young larvæ in the queen-cells. The bees must, therefore, when necessary, be brushed off the combs with a feather.

Modern methods of queen-rearing have been introduced, and instead of inducing bees to form queen-cells on the comb, they are now supplied with small cups of wax in which selected—very young larvæ are placed. These are fed by the nurse-bees, the cups are elongated and in due time sealed over, and then each introduced into a small cage or cell-protector and utilised in nuclei or otherwise.

The cups are made in wooden holders (Fig. 89), filled with melted beeswax, which is allowed to grow cold. It is then put in a warm place until the wax is of the consistency of putty, and a perfectly smooth hollow barely $\frac{3}{8}$ths of an inch in diameter is formed in it by pressure of a moistened forming stick, shaped as

in Fig. 90. The cavity in the holder is larger than the stick, so that a portion of the wax oozes out, and this forms the beginning of the cell-wall.

Mr. Sladen uses a special carrier to which the holders are fastened. This consists of a board $13\frac{3}{4}$ inches by 5 inches by $\frac{1}{2}$ inch, to the top of which is nailed a strip 17 inches by $\frac{1}{2}$ inch by $\frac{3}{8}$ths of an inch, having small strips $\frac{1}{8}$th of an inch thick, nailed on to either side of top-bar for spacing. Twelve wire nails $\frac{1}{2}$ inch long are driven 1 inch apart into a bar $\frac{1}{4}$ inch thick and $\frac{1}{2}$ inch wide. The bar is then nailed to the bottom of the board, as shown in Fig. 91, leaving the projecting points of the nails for fixing the holders to.

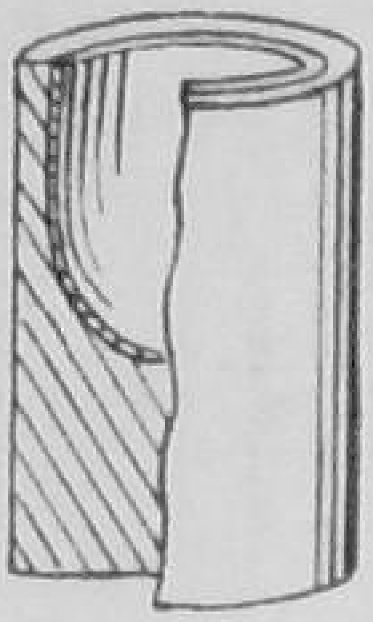


Fig. 89.
Cup-holder.

The cups are now ready for the larvæ, and are readily accepted by the bees if they are placed while empty for about twenty-four hours previously in a queenless hive, where they are partly converted into queen-cells, and acquire the scent of the hive. Select an unsealed queen-cell, and from this take a small quantity of royal jelly, about as much as will go on the point of a pen-knife, and spread it in the bottom of each cup. The larvæ are transferred in a warm room at a temperature between 75 and 80 deg. Fahr., and extreme care must be taken not to have them chilled. If too warm the jelly is likely to congeal; if, on the other hand, it is too cold, the larvæ are likely to become chilled, so that it is important to be within the temperatures mentioned. The youngest larvæ are then selected—those only just a shade larger than the egg are best—for it is important for rearing good

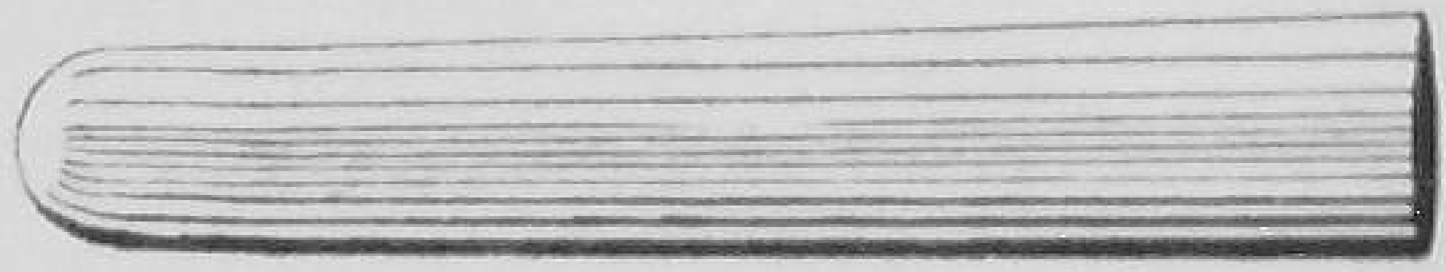


Fig. 90.—Forming Stick.

queens that the rich food be given to them from the earliest moment. All the cups for the same batch should receive larvæ of the same size, so that the queens may hatch about the same time. The larvæ are lifted out of their cells by means of a quill shaped as in Fig. 92. The tip is carefully slipped under the larva, which is then raised, together with the food in which it floats, and deposited in a similar position at the bottom of the cup to that which

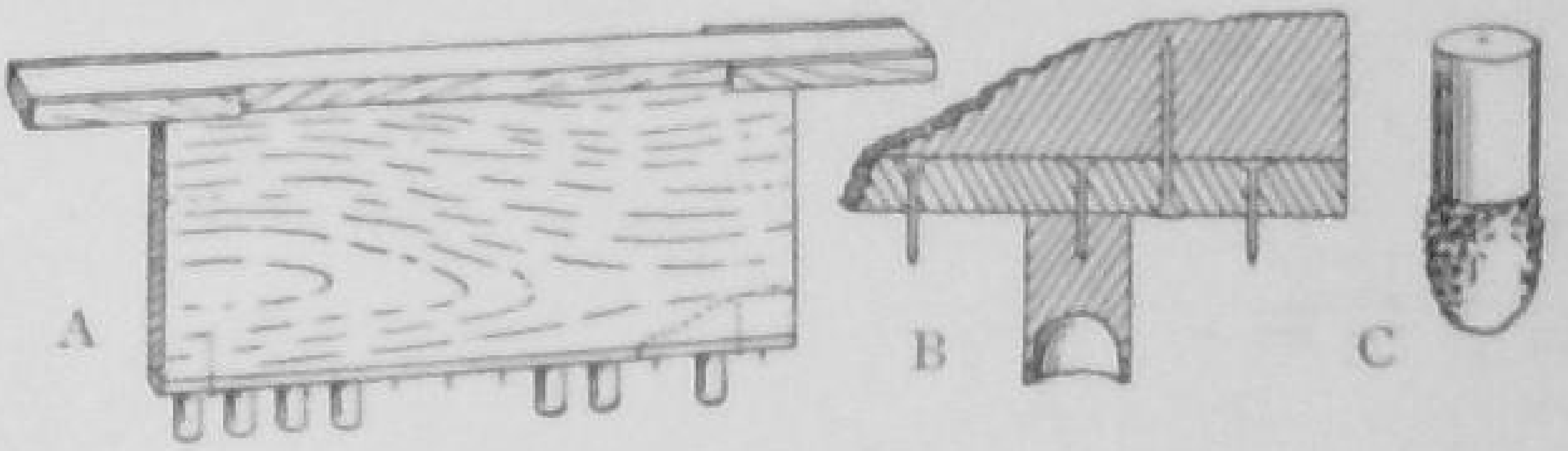


Fig. 91.—Carrier for Queen-cells. A, board; B, cup fixed; C, cell.

it occupied in the original cell. When the cells are provided with larvæ, no time must be lost in placing them in the queen-rearing colony.

The colony in which the queens are to be reared must be a strong one and have plenty of young bees. The queen should be removed twenty-four hours before the larvæ in the cups are given. Combs con-

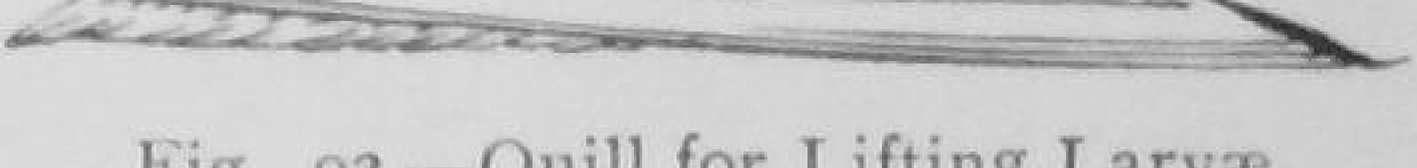


Fig. 92.—Quill for Lifting Larvæ.

taining young brood and eggs are removed and replaced by those having sealed and hatching brood. The queen-cells will be ready for insertion in nuclei on the tenth day after the larvæ are placed in the cups, and should it not be desired to rear another batch, one of the queen-cells may be left to hatch out while all the others are removed, thus re-queening the hive.

Another plan is to get the queens reared in a hive containing a fertile queen by placing them in a com-

partment of the hive from which the queen is excluded by means of a perforated zinc queen-excluder; this is considered by queen-breeders the most satisfactory method. Cessation of increase of brood in a part of the hive, and the exclusion of the queen, are sufficient inducement for the bees to rear queens there. For this purpose a large hive containing ten to twelve standard frames should be used. The queen-rearing compartment is prepared the day before the larvæ are given, and consists of two or three combs of honey and five of brood, together with the queen confined in the

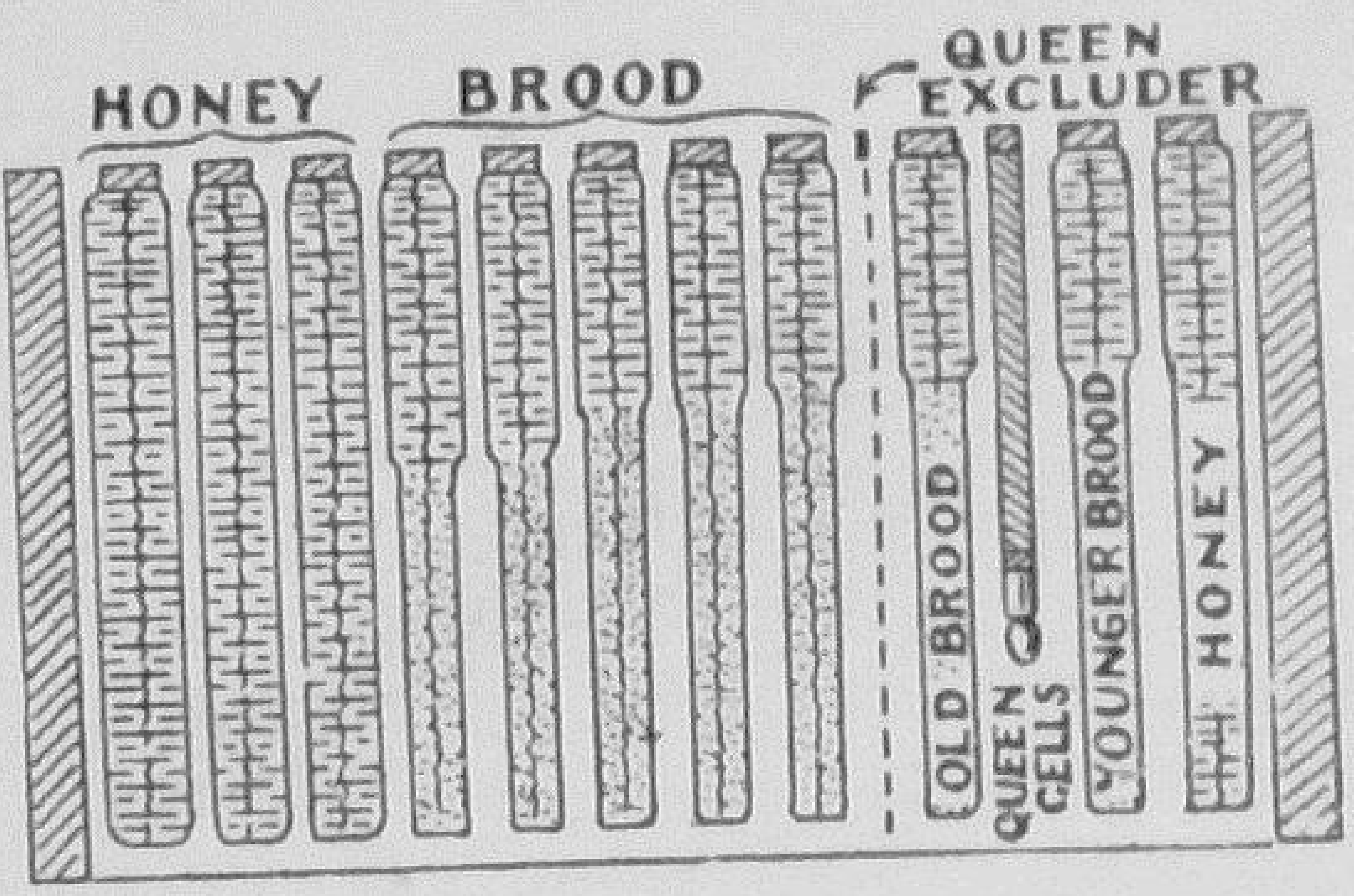


Fig. 93.—Section of Queen-rearing Hive.

space to the left in Fig. 93 by means of the queen-excluder, and on the right there is first placed a comb of old hatching brood, then a comb of younger brood, and lastly one containing honey and pollen. On the next day the carrier, with queen-cells, is introduced between the first two combs of brood, as shown in Fig. 93.

It sometimes happens, if the honey-flow unexpectedly fails, that bees dealt with on this method may neglect or destroy the larvæ given to them, but will readily accept them and attend to them after they have once been started. If there is a colony that is

superseding its queen, this should be utilised for starting the queen-cells, which could be left with it for about forty-eight hours.

Instead of introducing ripe queen-cells into nuclei, the queens may be introduced after they have emerged from the cells. On this plan the cells are placed in a nursery-cage devised by Mr. Sladen (Fig.

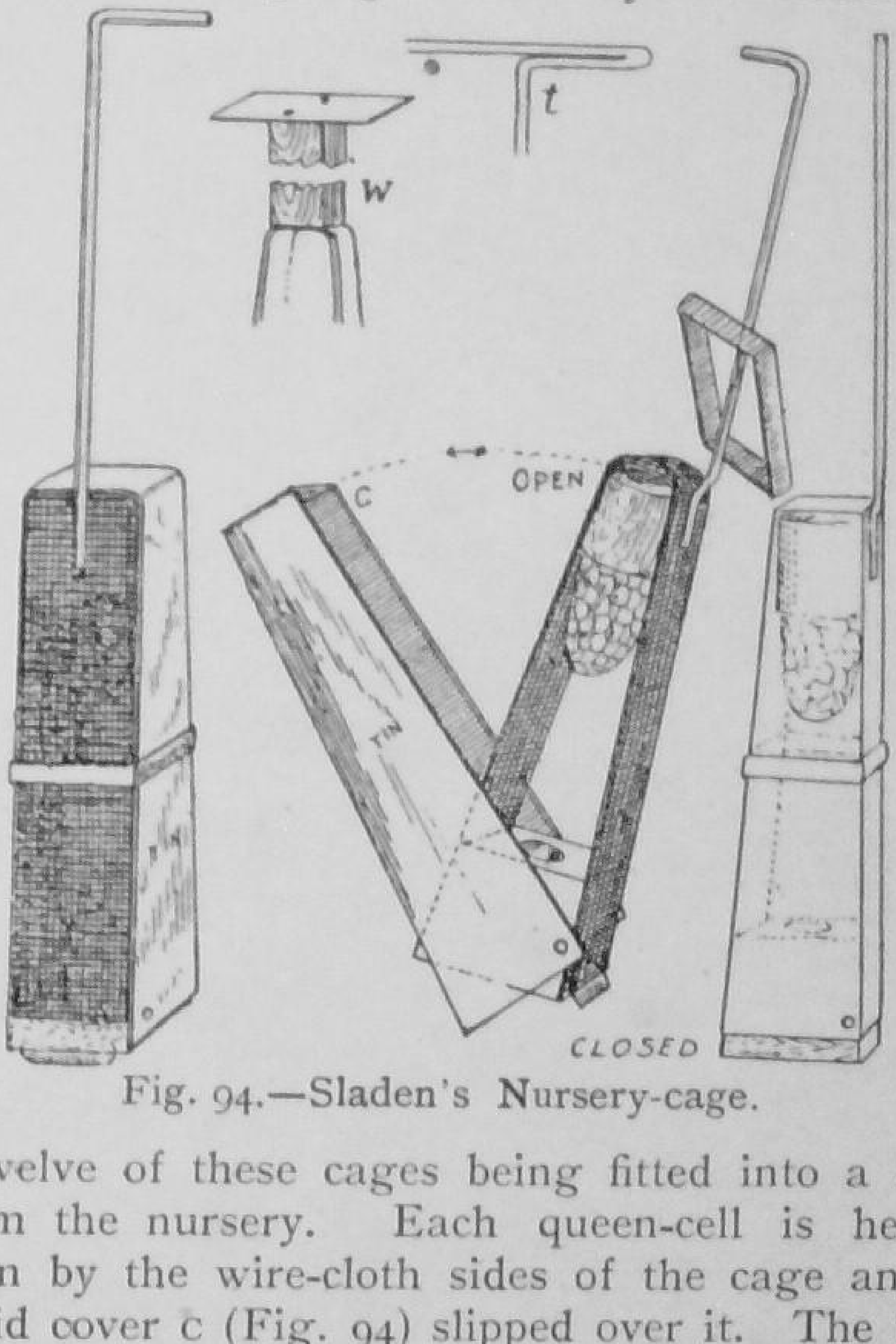


Fig. 94.—Sladen's Nursery-cage.

94), twelve of these cages being fitted into a frame to form the nursery. Each queen-cell is held in position by the wire-cloth sides of the cage and the celluloid cover c (Fig. 94) slipped over it. The frame containing the twelve cages is placed between combs of brood in a strong colony, and may remain there until the queens are wanted for insertion in nuclei.

Any of the cages can be removed from or inserted into the frame without lifting it out of the hive.

For further details and other methods of rearing queens the reader is referred to "Queen-Rearing in England," by F. W. L. Sladen, F.E.S.

XXV.—NUCLEUS-HIVES.

A nucleus is a colony of bees on a small scale, and may be formed by removing two or three combs from a populous stock, one of which should contain honey and pollen and the others brood. These are placed in an ordinary hive, and enclosed by division-boards to economise the heat. The combs are removed along with the adhering bees, care being taken that the queen is not with them. As all the *old* bees will return to their hive, shake or brush the young ones from one or two other combs into the nucleus, so as to introduce about a quart of bees, which will stay and be sufficient to keep the nucleus at a proper temperature. Insert empty combs or frames of comb-foundation into the hive from which the full combs have been removed, in the manner described in "Nucleus Swarming" (page 95). Proceed in the same way, and form as many nuclei as there are queen-cells to introduce.

Cover the frames with a quilt and reduce the entrance, so that only one or two bees can go in and out at a time, to prevent robbing. The nuclei are now ready to receive queen-cells.

Remove the frames of queen-cells from the stock containing them, and carefully brush the bees off the combs, observing the caution mentioned on page 127. Then with a sharp, thin knife cut out all queen-cells except one.

Be careful not to damage the cells, or the inmates may be injured; and do not expose them long to cold air or hot sun, or the royal occupants may be destroyed. Unless the bee-keeper is proficient at this work, it would be well to remove only one cell at a time, and return the frame from which it was taken to its position in the hive until the cell is inserted in its place in the nucleus. In cutting out the cell, leave a piece of comb attached to it above (see Fig. 8). The cell should now be placed between the combs of the nucleus, point downwards, and secured on one of them by pinning it with one or two pins thrust through the cells attached to the queen-cells. Or the cell may be placed in a spiral wire protector (Fig. 95), which prevents the sides from being torn open. The projecting end of wire is pressed into the comb, so that the queen-cell will hang in the middle of the cluster, and a tin cover slipped in above will keep it safe from the bees. Close up the space with the division-board, cover with the quilt, and feed with syrup. After all the nuclei have received their cells, they must be watched to see that sufficient bees remain. If too many leave, add more in the way before described. Three to four days later the queens will hatch, and in a week or so they will have become fertilised by selected drones (which would by this time be flying freely), since up to the present time we have no others in the apiary (see "Queen-Rearing," page 123).

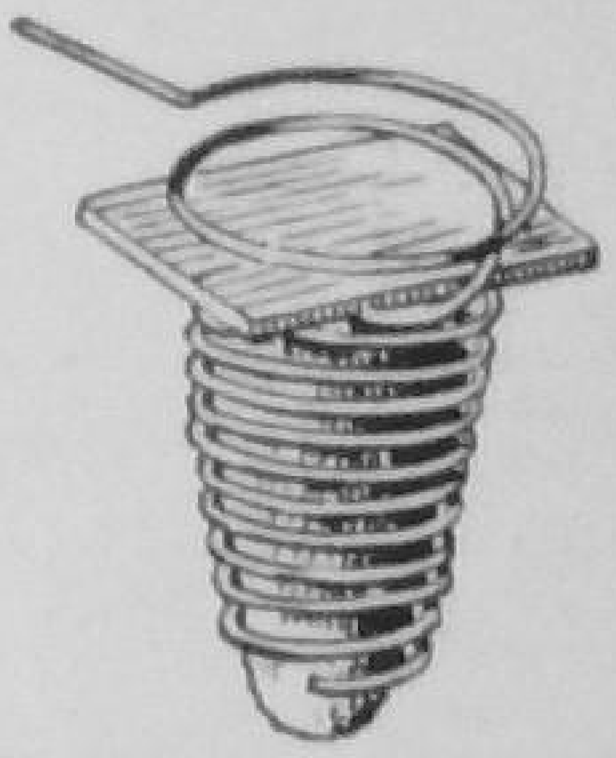


Fig. 95.—Queen-cell Protector.

If queen-cells have been made in holders, ripe ones (see page 129) should be introduced to each nucleus in the evening, and great care must be taken not to injure them by shaking or jarring, and they should

be out of the hive as short a time as possible. The wire protector can be used, and Mr. Sladen recommends two or three coils to be drawn out and attached to a cross-piece of wire, so that the queen-cell is easily inserted into the nucleus without lifting out a frame.

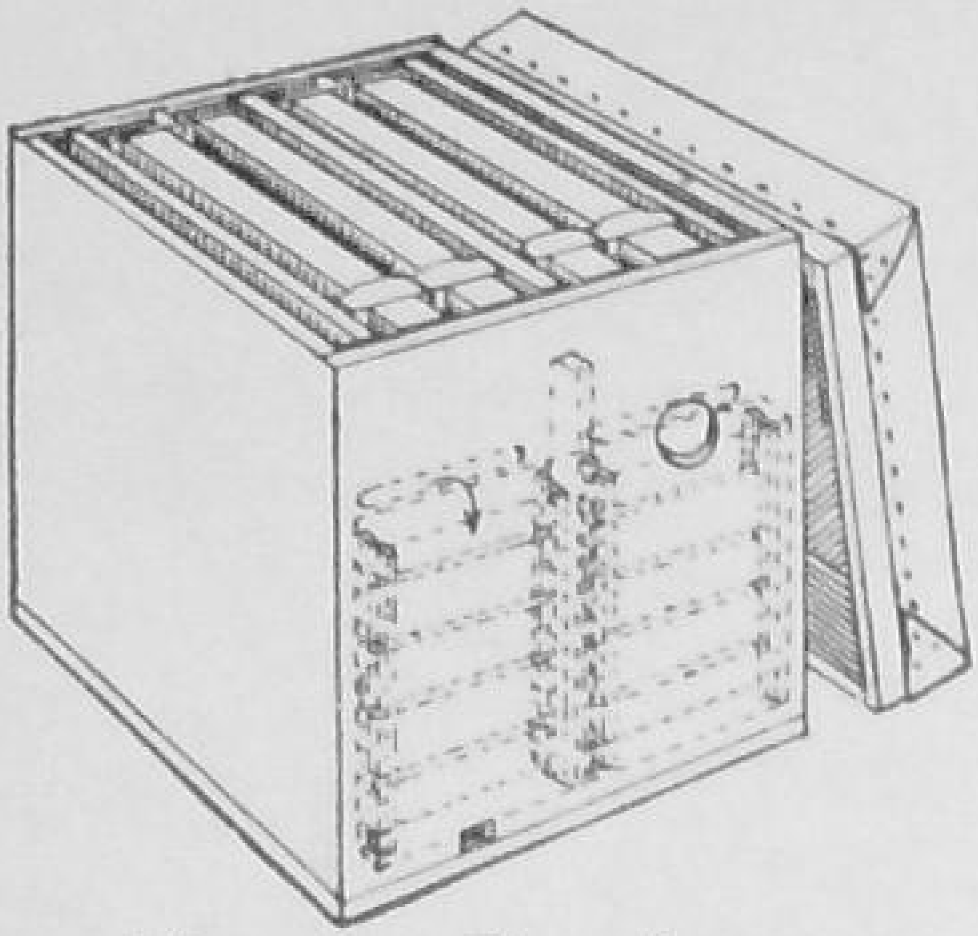


Fig. 96.—Two-frame Nucleus.

When queens are kept in nuclei until fertilised and laying, care must be taken that the young queen, on leaving the hive for mating purposes, is not accompanied by the whole of the bees, and so all be lost. To prevent this, a comb containing unsealed brood is, beforehand, given the bees to take care of, and this keeps them from decamping as stated. Bees very seldom desert young brood.

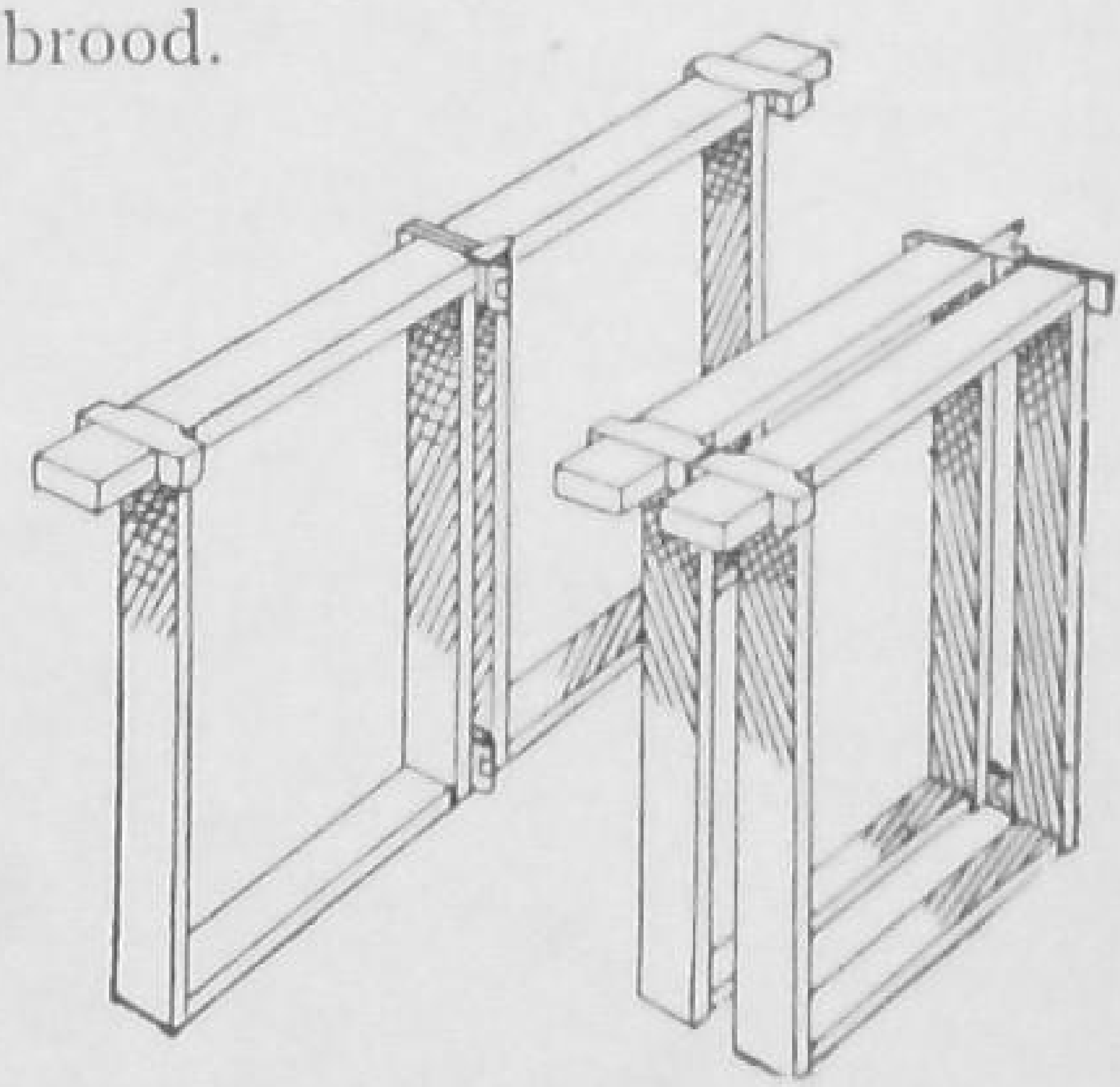


Fig. 97.—Folding-frame for Nucleus-hive.

Mr. Sladen has recently introduced a small hive, holding two frames (Fig. 96), which forms two nuclei for the economical fertilisation of queens. Each frame is hinged in the middle, and will not only hang in an ordinary full-sized hive, but is capable of folding up to make two half-frames (Fig. 97) for use in the nucleus-hive. The two nuclei are separated by a partition which can be removed when it is desired to unite them. The hive is fitted with a side-wall

feeder, and the roof covered with waterproof sheeting. The frames can be fitted with comb-foundation and brood reared in them as in the ordinary standard frame.

Should the cells not hatch or be destroyed, or if queens be lost (which is easily ascertained among so few bees), other queen-cells may be introduced to try again.

Having assured ourselves of the presence of the queens, we can ascertain if they have commenced to lay by examining the combs for eggs; and if any be found, the queens producing them are ready for utilising, but can remain in the hives until wanted.

XXVI.—INTRODUCING QUEENS.

When introducing queens some precautions are necessary or the bees are likely to destroy the stranger presented to them. If a queen is confined in a cage for a time on one of the combs and then released, she is generally accepted. Various contrivances have been devised for this purpose—the simplest being the pipe-cover cage, into which the queen to be introduced is placed and a card slipped underneath. The cage and card are then placed on the comb, where the former is to be fixed. On withdrawing the card, press the cage into the comb with a screwing motion as far as the base of the cells (Fig. 98), taking care not to injure the queen's legs. Selecting a central comb containing brood and honey, the queen is caged on this, so that she may find food when she requires it. The bees are then sprinkled

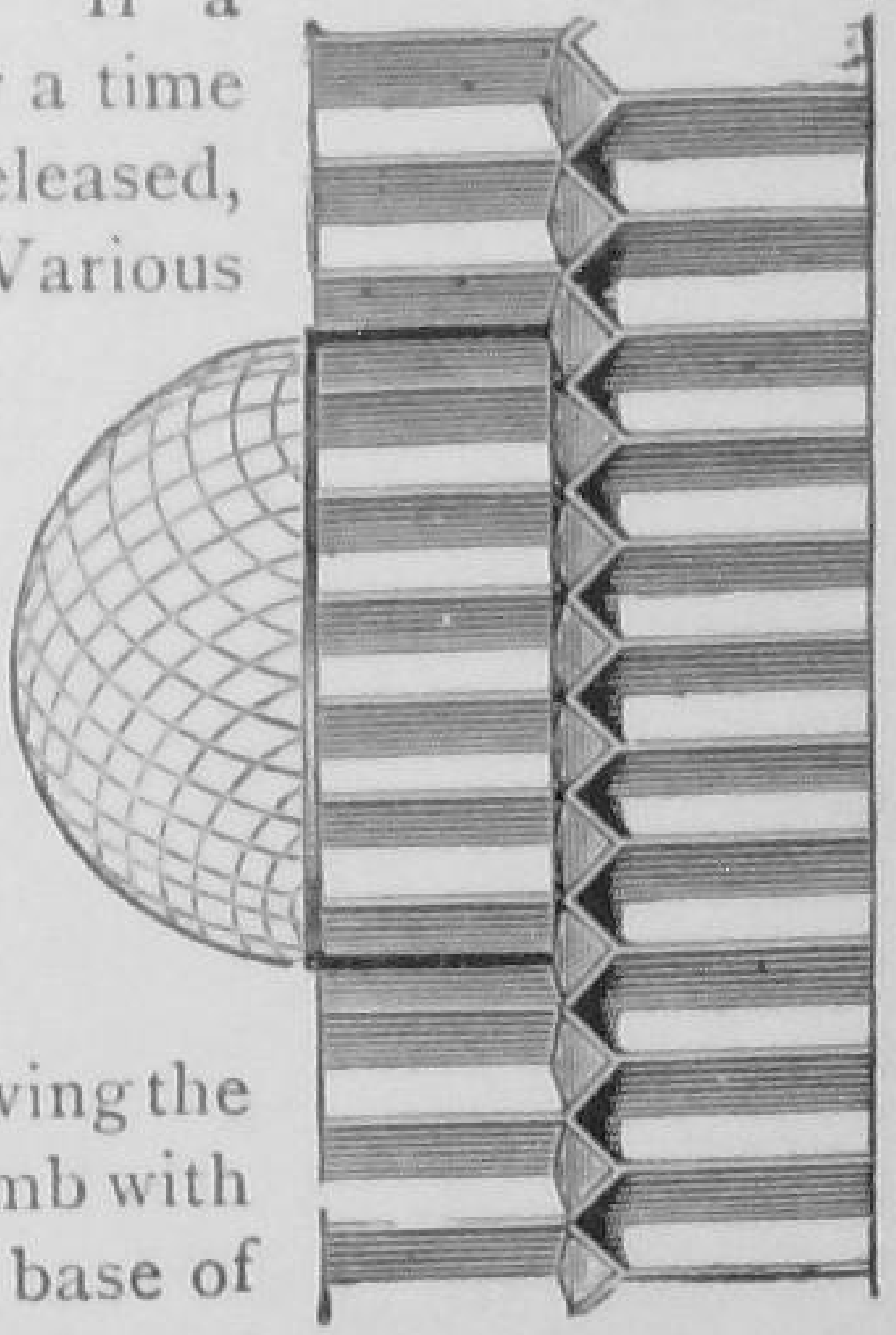


Fig. 98.—Pipe-cover Cage pressed into Comb.

with thin syrup, and a bottle of food placed on the top of the hive. In twenty-four hours the hive is then opened and the cage removed. Watch the queen for a few seconds, and if the bees do not attack her, the comb may be replaced; but if, on the other hand, she is seized by the legs or wings, cage her again and release in the same way next day.

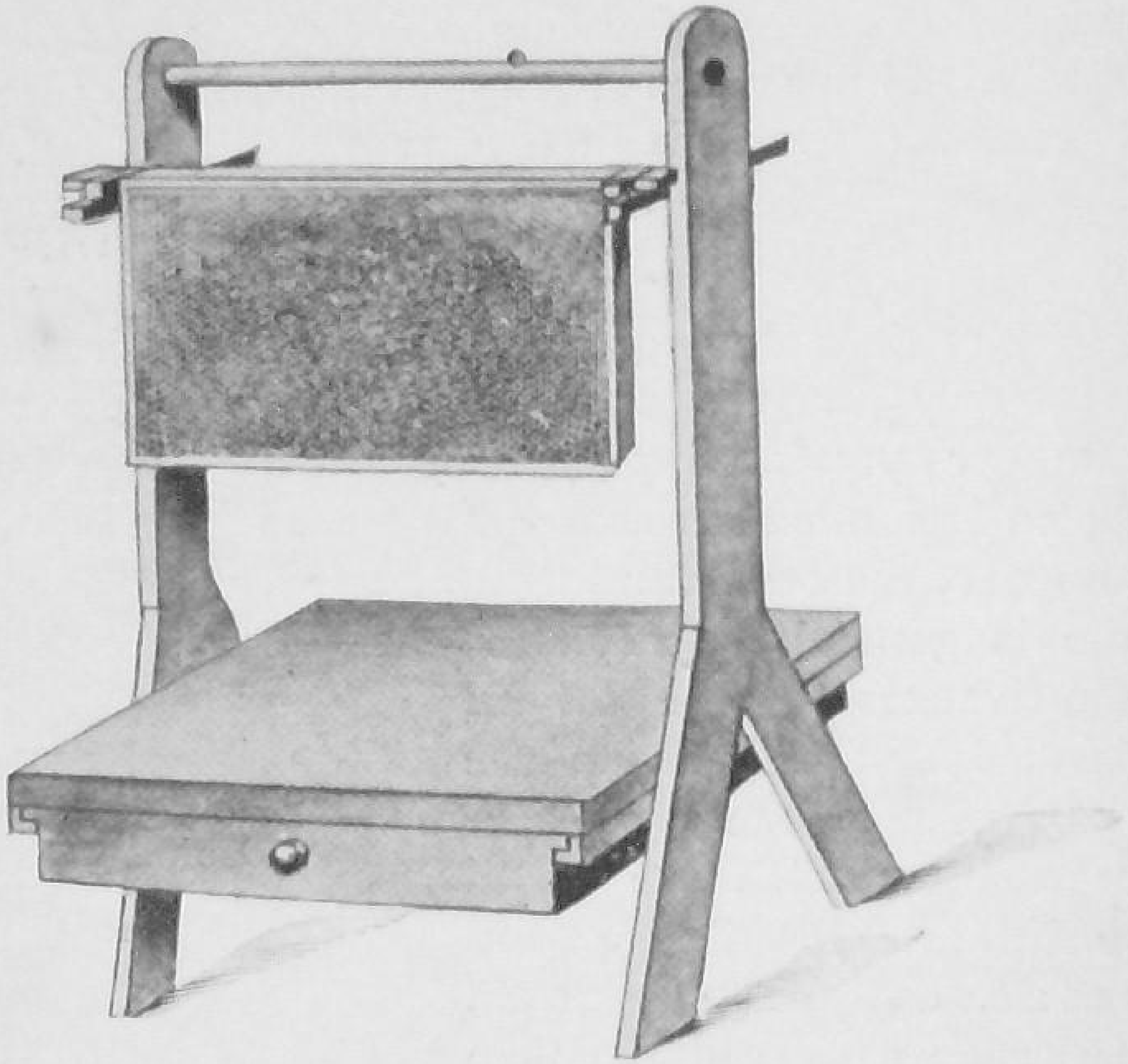


Fig. 99.—Comb-stand.

In changing a queen, she must first be removed from the hive. In order to find her most easily, open the hive on a fine day when many bees are away from home. Take out the central comb first, and examine both sides, and, if the queen is not found, hang it on the comb-stand (Fig. 99). Examine the remainder of combs until the queen is seen; then, seizing her gently

by the wings (see illustration below), place her at once in the cage.

After the queen is caged, replace combs. It is also advisable to cut out all queen-cells, for with no means

Fig. 100.—Picking Queen-bee off Comb.

of raising a queen the bees will generally accept a fertile one.

The illustration, taken from life (see page 139), will be helpful in enabling beginners to distinguish the queen-bee on a comb, besides dispelling the illusion that the queen is always surrounded by her attendant bees.

It also plainly shows the difference between sealed honey—seen right across the top portion of comb—and sealed cells containing brood, a small patch of the latter being clearly visible just below where the queen is standing. Immediately in her rear are also seen a few open cells in which, on close inspection, the crescent-shaped larvæ may be observed lying at the bottom of the cells.

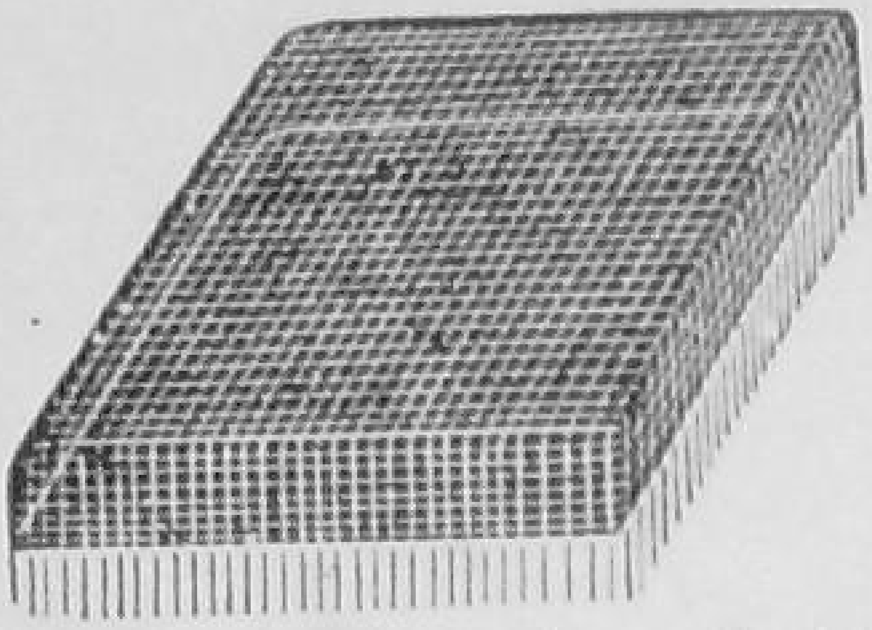


Fig. 101.—American Cage.

Fig. 101 shows a cage much used in America. It is made of woven wire nine meshes to the inch, and is 2 inches square. The lowest strands of wire on the sides are pulled out, leaving points projecting about $\frac{1}{4}$ inch, which are pushed into the comb until the horizontal wires at the sides rest on the surface, and in this way leave a depth of $\frac{1}{2}$ inch inside. The cage is kept firmly in position, and the bees gnaw through the comb under the wires, and thus liberate the queen.

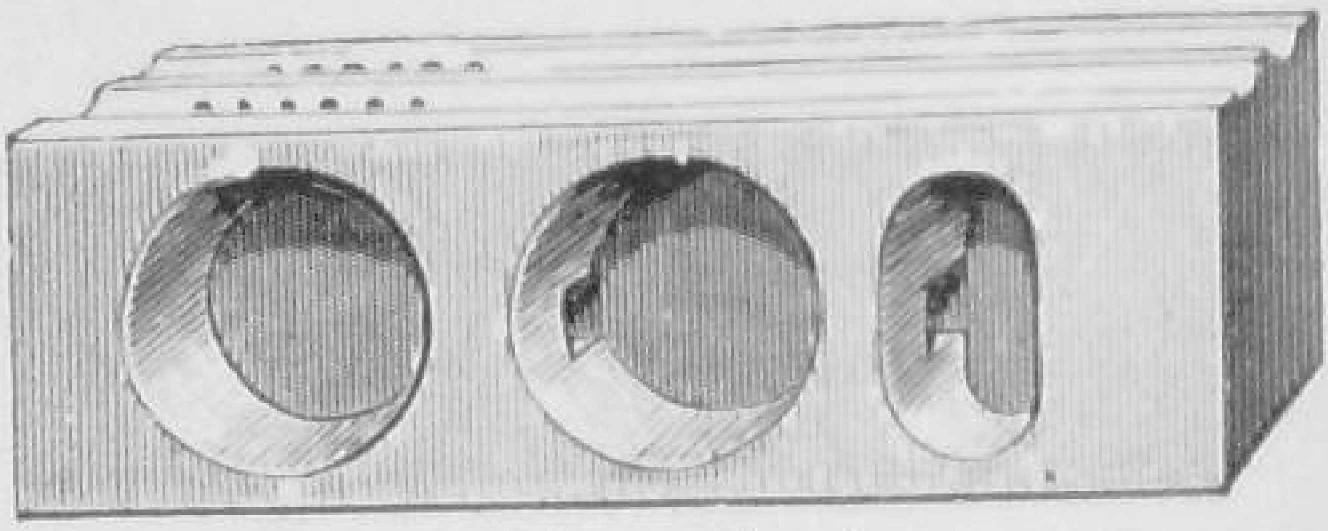


Fig. 102.—Introducing-cage.

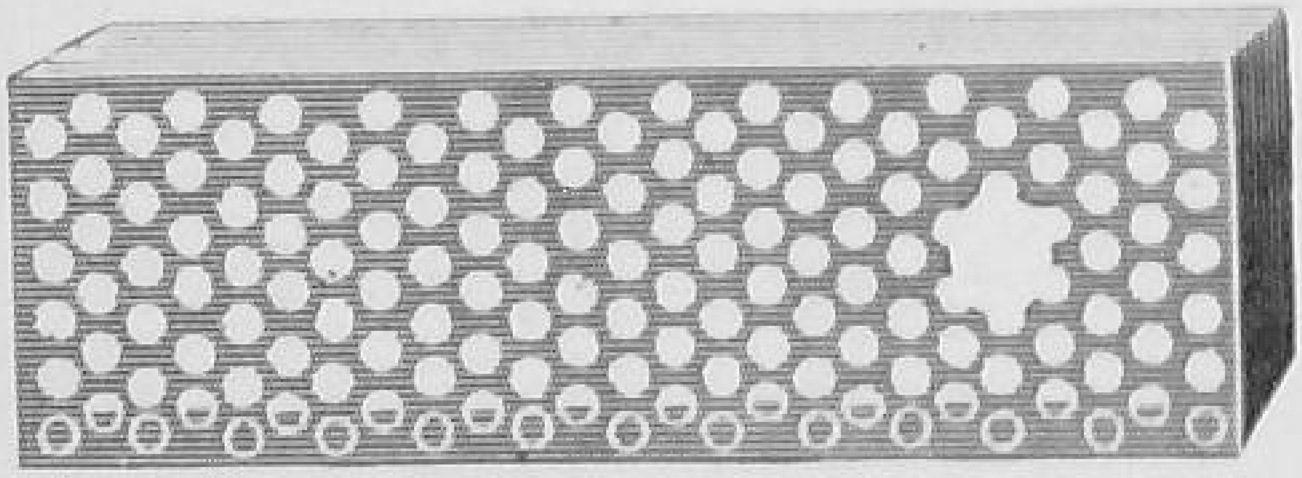
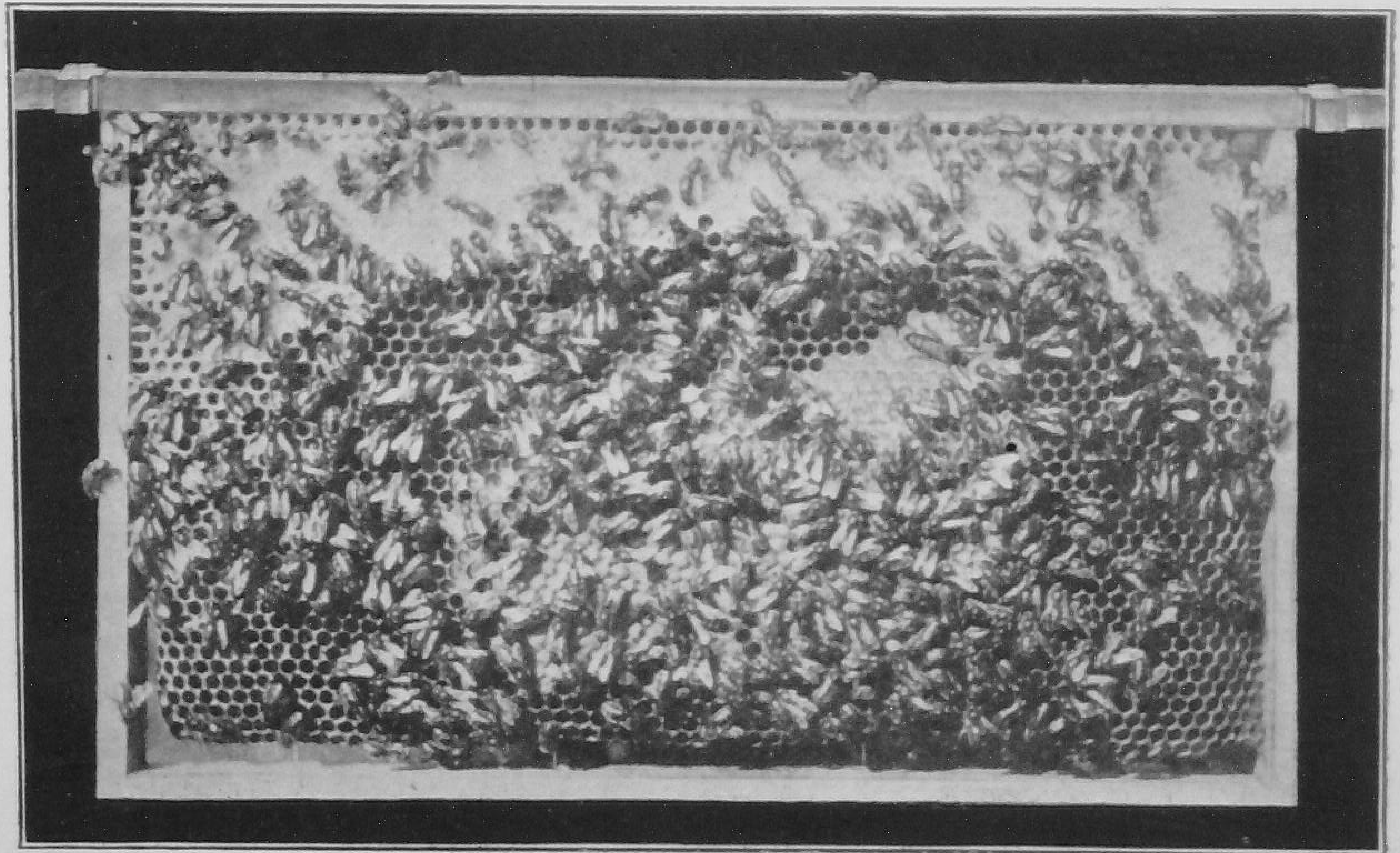


Fig. 103.—Cover for Introducing-cage.

Queens may be introduced successfully by means of the travelling and introducing cage (Fig. 102). The cage consists of a block of wood, having three cavities, in the smallest of which is placed soft candy made according to the directions in Recipe



Frame of Comb with Bees and Queen (from life).

No. 3, on page 196. The queen and her attendants are placed in the larger cavities, which are in communication with the smaller one, so that when the perforated zinc cover (Fig. 103) is placed over the openings, the bees inside may get at the candy, which is covered with a piece of paper. At the side of the travelling-cage small holes are bored, which admit air to the bees inside. A wooden lid is placed over the perforated zinc, and the whole tied and labelled for posting. On receipt of queen, the wooden lid is removed, also the piece of paper covering the candy. See that there is a good supply of this, and if much has been consumed, add sufficient to fill the cavity. Place perforated zinc so that all three holes are covered, and put the cage, zinc downwards, on the top of the frames, taking care that the holes come over the opening between the centre frames. The cage is allowed to remain in this position for ten to twelve hours; then slide the wooden box only forward to the turned-up end of zinc, so that the food comes over the large hole. In from one to two days the bees in the hive will eat through the candy, and thus liberate the queen. The cage must not be removed, or the colony disturbed for at least two days after the queen has been liberated.

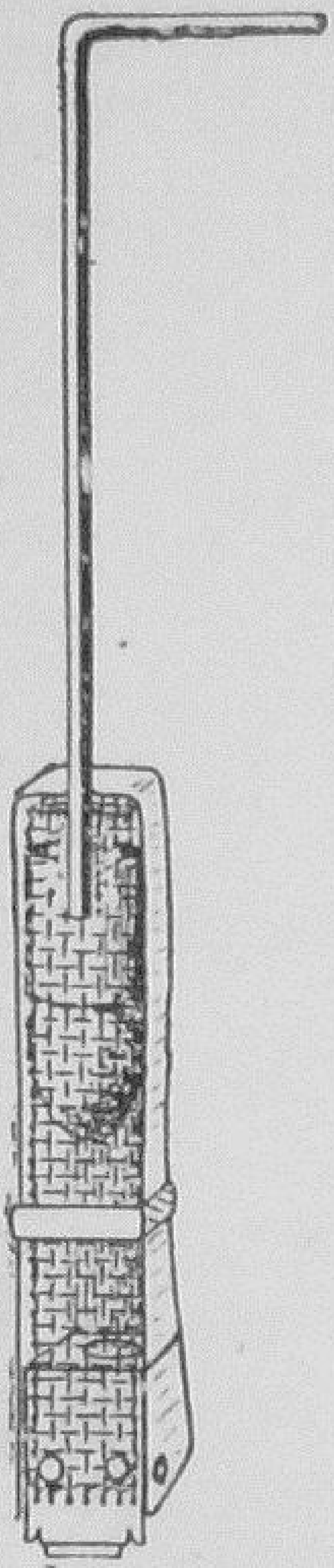


Fig. 104. Sladen's Nursery Cage.

Mr. Sladen's hatching nursery-cage (Figs. 94 and 104) can also be used for introducing queens. The hole in the wooden block at the bottom is filled with candy (Recipe No. 3, page 196), care being taken that the tin slide at the bottom covers the hole. He recom-

mends placing the queen alone or with one *just-hatched* worker from the colony to which she is to be introduced, and hanging the cage between brood-combs in the hive. The next day draw the tin slide away. The bees liberate the queen by eating out the candy in about twenty-four hours, and the colony should not be examined until a week later.

Queens are very easily introduced to swarms, and if a stock is reduced to the condition of a swarm, it will readily accept a queen. Move the hive and take out the queen from the colony to which you wish to introduce a strange one, shake or brush all the bees from their combs, and allow them to run into an empty skep placed on the stand. Then place the hive containing the combs on the original stand, shake the bees out of the skep on to a board in front, and as they run in drop the queen amongst them. Although this process is tedious, it is quite certain if properly carried out.

Mr. Simmins recommends direct introduction, as follows:—Remove the queen from the hive. Then put the one to be introduced in a box by herself, and keep her in a warm place for thirty minutes without food. At dusk lift the corner of the quilt, drive back the bees with a little smoke, and allow the queen to run down.

Failures will occasionally occur, and if queens are choice ones, the pipe-cover cage first described is to be preferred, as in releasing the queen we can always see if she is favourably received; and if not, we can take precautionary measures to ensure her safety. It is sometimes very difficult to introduce queens into hives having no young bees, as the old bees frequently "ball" (see page 122) the queen and hug her to death unless she be released. If it is possible, hives which have been for some time queenless should have frames

of hatching brood inserted, and the queen to be introduced caged on one of the combs, releasing her at the end of three days.

A colony that has lost its queen, and not having brood of proper age from which to rear one, will readily accept an unfertilised young queen even without caging.

XXVII.—ITALIAN BEES

This variety—sometimes called Ligurian—was introduced into this country in 1859 by Mr. Woodbury from a district amid the Alps, including portions of Switzerland and Northern Italy, where it is indigenous.

The Italian bee is similar in form and size to the black bee, but lighter in colour, and has three distinct yellow rings about the body below the wings. It is more prolific than the black bee, more active, working earlier and later, increases more rapidly, is ready for swarming earlier, and gathers honey from plants which are not frequented by the black bee. Pure Italians are also of a more amiable disposition, and less inclined to sting, therefore are more easily handled. The introduction of Italian bees has done much to improve our race of black bees by introducing new blood and correcting to a great extent the mischief which had inevitably resulted from in-and-in breeding.

Changing a Stock of Native Bees to Italians.—The queen being the mother of the whole colony, the increase of that variety cannot continue if she be removed and an Italian queen substituted. The Italian queen given to the colony will commence laying eggs soon after she gets on the combs. Three weeks later her progeny begin to hatch, taking the

place of the black bees that are dying from natural causes, and in from four to six months all the black bees will have disappeared and their places be filled by pure Italians.

The queen with which you wish to commence Italianising should be pure beyond doubt. Purchase an imported one of some reliable dealer who can guarantee her purity. As soon as the box containing the queen is received, take it into a room, shut the window, and open the box before it. Lift out the little frame on which she has travelled, and pick the queen from the comb, seizing her gently by the wings. Put her into a cage, and, after removal of the black queen, she may be introduced into the hive by one of the methods described.

If queen comes in an ordinary postal travelling-cage, she must be removed from this and placed in one of the cages described under "Introducing Queens" (page 135).

The queenless part of an artificial swarm may have a queen introduced in the spring. One may be given to a natural swarm after finding and destroying the queen of the latter.

XXVIII.—CYPRIAN AND SYRIAN BEES.

These bees were introduced into England a few years ago. They are rather smaller than Italians, but much brighter in colour, and the bands are more strongly marked. The thorax is also yellow. The drones are smaller and brighter in colour. As far as appearance goes, they are certainly the most handsome bees cultivated. They are extremely prolific, excellent honey-gatherers, and our own experience of

them was that colonies vary in temperament, some being gentle and others very vicious. Pure Cyprian queens of a different strain have been recently introduced, and a good many have been distributed, so that we hope to hear more about their qualities from those who have tried them.

XXIX.—CARNIOLAN BEES.

These bees have been imported from Carniola, a small district in South-Western Austria. They are similar to the common black bee in appearance, but have much lighter rings on their abdomen. The queens are larger and of a light brown colour. They are distinguished particularly by their good temper when disturbed and easy appeasement during manipulations, can be handled with impunity without smoke or veil, and are quite hardy, wintering well. They adhere closely to the combs, although easily shaken off, and, instead of flying, at once make for the hive. Although so gentle, they determinedly defend their hives should other bees attempt to effect an entrance. Their combs are very white, as they use but little propolis, and the appearance of their comb-honey is not to be surpassed by that of any other race. Their principal failing is a propensity for excessive swarming, the queens being exceedingly prolific. The disposition to swarm may be moderated, or even entirely prevented, by giving them plenty of room and ventilation in large hives, allowing a current of air to pass through them. Carniolans are excellent honey-gatherers and very industrious. Owing to their gentle temperament they may be recommended to beginners in preference to any of the other races.

XXX.—STARTING AN APIARY.

The beginner should never attempt to start on a large scale. He should commence with one or two hives, increasing the number as he gains knowledge and experience, by swarming or purchase. The best way is to start in the spring by the purchase of a swarm as early in May as possible, from a hive which was known to have swarmed the previous season. The queen of such a swarm would be in her second year—vigorous and in her prime. Remove the swarm to your apiary in the evening in the straw skep in which it was hived, and introduce it into a movable-comb hive in the way shown on page 30.

A beginner may judge the strength of a swarm by its weight or measure, and for this purpose the following data will be of use:—15,000 bees, weighing about 3 lbs. or measuring about a gallon, constitute a medium swarm.

25,000 bees, weighing about 5 lbs. or measuring, say, seven quarts, constitute a good swarm.

When buying swarms by weight, it must be borne in mind that a swarm always weighs less when received than when despatched if the journey occupies any length of time, therefore some allowance must be made for loss.

If it is decided to purchase a stock in skep in the spring, first examine it thoroughly. Drive the bees up among the combs with smoke, and invert the skep. Care should be taken that the skep is turned up, with the combs running in the direction shown in Fig. 105. If turned sideways, the weight of the combs may cause them to break away from their attachments. The combs should be free from mould, and the hive contain a large number of bees. If on pushing the

combs apart brood is found, it indicates the presence of a fertile queen. The combs should be straight,

Fig. 105.—How to Turn up Skep for Driving Bees.

coming entirely down to the bottom of the hive. If the combs are not too old such a hive may be pur-

chased. Remove it very early in the morning, or late in the evening, when all the bees have returned home, and place it on a stand in your apiary (see "Moving Bees," page 116).

On no account should a beginner purchase a stock without having a guarantee of its being free from foul brood.

DRIVING BEES.—The many ways in which the operation of "driving" is found useful render it necessary that every bee-keeper should be thoroughly conversant with the best method of procedure, which is as follows:—Select a fine day, when many of the bees are out gathering honey, remove the skep to some quiet, shady spot, and put an empty skep in its place to receive the returning bees. Blow some smoke into the skep to induce the bees to fill themselves with honey. After an interval of a few seconds, give more smoke, invert the hive, if flat-topped, on to a table (or tub), and place an empty skep over it, as shown in illustration on next page, bringing the edges together at the point towards which the combs run. Push a skewer or a wire nail through its edge in the lower hive so as to form a sort of hinge, and support the upper hive by means of "driving-irons," *i.e.*, a couple of iron rods, bent at ends as in Fig. 106, thrust into the skep as seen on next page. Stand at the side so that the strongest light shines into the hive, and with open hands start rapping on the sides to which the ends of the combs are fastened, hard enough to jar the combs, but not so hard as to run the risk of breaking them from their attachments. The strokes should be

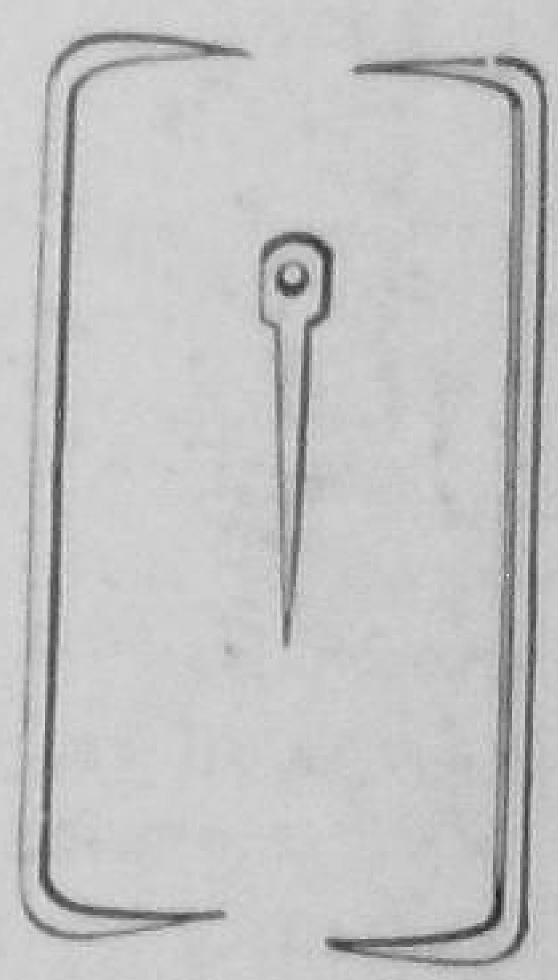


Fig. 106.
Driving-irons.

Driving Bees. How to Strike Skep (front to back).

from front to back and continuous. After a few raps the bees will begin to ascend into the empty hive. In from five to twenty minutes, according to the state of the weather and the strength of the hive, the whole of the bees may be driven out. If the weather be chilly or honey scarce, the bees will leave the hive more readily if about ten minutes before commencing to drive we pour a little warm syrup between the combs; the bees will become excited, and raise the temperature of the hive, and, in consequence, will drive more easily. The movable-comb hive is placed on the old stand, and the driven bees and those in the skep—placed temporarily on the stand—can be run into it.

If it is desired to make an artificial swarm, drive the bees in the same way, but as they are being driven a sharp look-out must be kept for the queen. If she is seen to run up into the empty skep, stop the driving when about half the bees have left; put these into a frame-hive, and place it and the old stock on opposite sides of the old stand, about 3 feet apart. Should one appear stronger than the other, remove it further and bring the other nearer to the old stand. Should too many bees be driven out of the stock-hive before the queen is found, some may be returned.

Transferring. — In these days of cheap comb-foundation transferring old combs and bees from skeps to frame-hives is not advisable. It is found more advantageous in every way to have new, straight combs built out from full sheets of foundation, in lieu of filling the frames with patched-up old combs cut from skeps, which, at the best, are not only less workable, but liable to carry the hidden germs of disease into the hives to which they are transferred. The safest and most simple plan is to allow the bees to transfer themselves from skeps to frame-hives, in

spring, by the following method :—First prepare the frames as mentioned by fitting them with full sheets of foundation, and place above top bars a piece of American leather-cloth large enough to cover all the frames. In centre of this covering a hole 4 inches square is cut, to provide passage-way below for the bees. Choosing a fine day in the early part of April

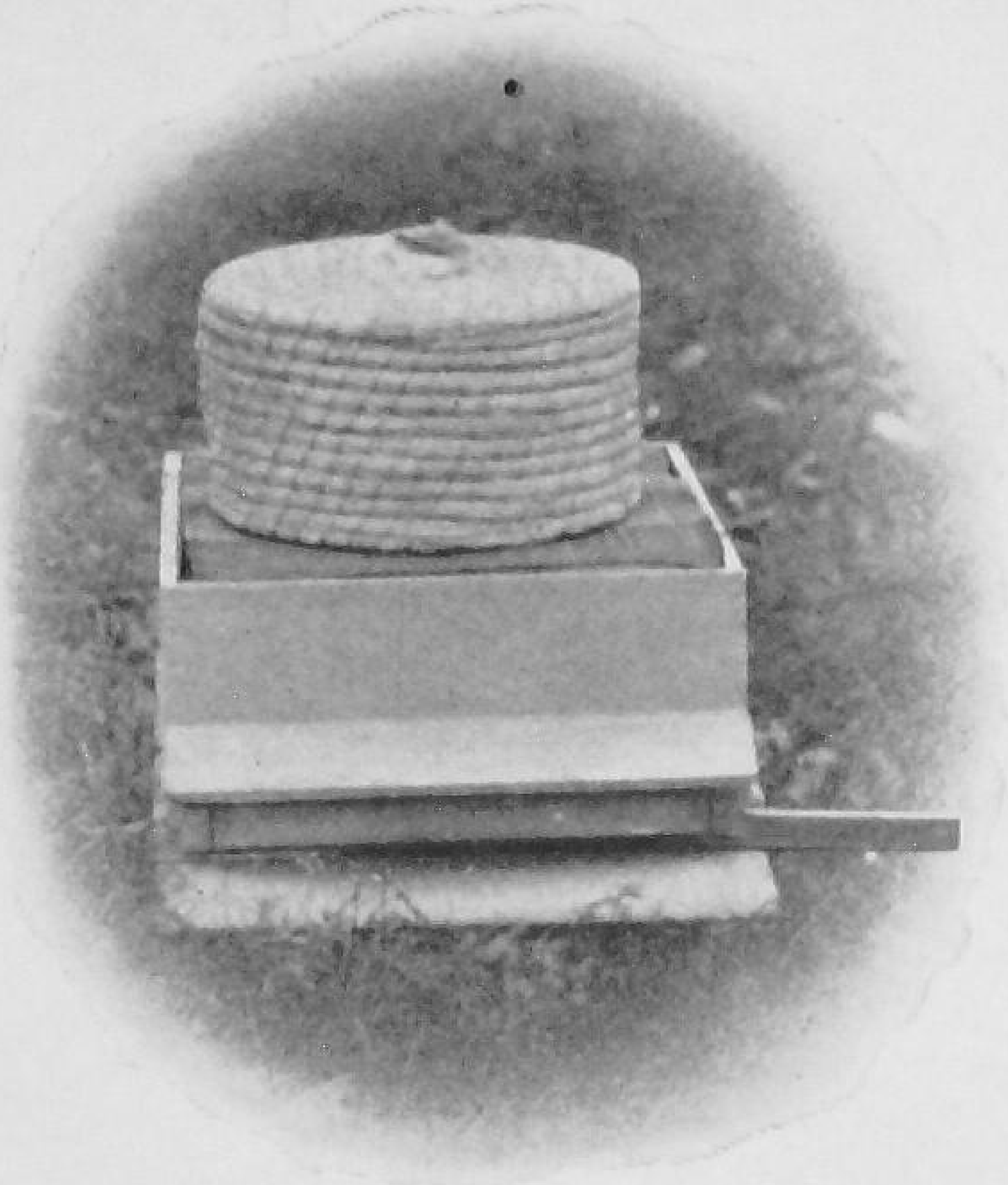


Fig. 107.—Bees Prepared for Transferring themselves from Skep to Frame-hive.

—or later on, according to the locality—when the bees intended for transfer are seen to be working well and strong in numbers, the prepared frame-hive is placed on the stand occupied by the skep, and the latter, lifted from its floor-board, is set above the leather-cloth which covers the top bars of frame-hive (Fig. 107). This done, the part of hive not covered by the

skep is packed round as closely as possible with warm coverings of suitable material, so as to make the lower hive as warm and snug as possible.

This completes the operation until the bees and queen have taken possession of the lower hive and established the brood-chamber therein.

In due time all brood in the skep will have hatched out, and the bee-keeper may at discretion either remove the skep and its contents prior to supering the frame-hive, or allow the combs in skep to be filled with surplus honey for removal later on.

Some transfer by driving bees and queen from skep, then set the latter above frame-hive, with excluder between, and run the driven bees in at entrance. The queen is thus got below at once, but if a cold night supervenes the danger arises of bees re-entering the skep to cover brood, and leaving the queen to perish of cold and hunger below.

XXXI.—BUILDING UP STOCKS.

After deciding to build up stocks from driven bees, the hives to receive the latter should be prepared beforehand by fitting them up either with frames of built-out comb, or full sheets of foundation in wired frames. On no account must built-out combs be alternated with sheets of foundation, or the result will be irregular combs similar to those seen in Fig. 108, which will, in consequence, be practically unworkable. When two or three lots of driven bees are united (in order to make up a very strong colony), and the operation is performed not later than the end of August, there is ample time to get entirely new combs built out from foundation, and the food sealed over before warm

weather ends and cold nights cause the bees to cluster closely and cease comb-building. Not only so, but if the queen is young and prolific, a good batch of autumn-bred bees will be raised to become the earliest and lustiest workers of the following spring. In this way bees obtained before August ends may be compared to May swarms.

On the other hand, if the driven bees are not available till September is half over, stocks built up from them should, if possible, be hived on ready-built combs, and fed with good thick syrup in a rapid feeder, which must be refilled as often as emptied. The food should be given slightly warm in the evening and the feeder warmly wrapped up. The heat thus generated will permeate the whole hive, rendering the bees active, and enabling them to carry the food down quickly during the night. Buying driven bees by the pound is a more satisfactory method of purchase than by the "lot," unless some stipulated weight is arranged for; 1s. 6d. per lb. is the usual price, so that a 5s. lot should weigh from 3 to 4 lbs. This would be considered a fair-sized lot, though a heavier one would of course be better.

Driven bees on arrival (particularly if sent a long distance) should be fed with warm syrup in the travelling-box, to liven them up before hiving. The hive is placed in position on a newspaper, as in a swarm, with its front wedged up an inch or so from the floor-board. Then unscrew or loosen the lid of the travelling-box, and, holding box and lid firmly together, turn it over and allow the bees a few minutes to crawl up to top of box as inverted. This done, lift the box gently apart from the lid, and set it down in front of the hive. A smart rap will dislodge the bees from box, which is at once lifted up and the bees allowed to run in the hive. If the latter is of the type seen on

page 30, the roof may be used as a platform for throwing the bees on to, when hiving them, as shown.

The best time for the operations described above is after sundown, when bees have ceased flying for the day, the final item, viz., hiving the bees, being done in the dusk of the evening, when very few bees will take wing if carefully handled. It is also very advantageous to give a good-sized cake of soft candy (see page 191) to each stock before packing down for winter.

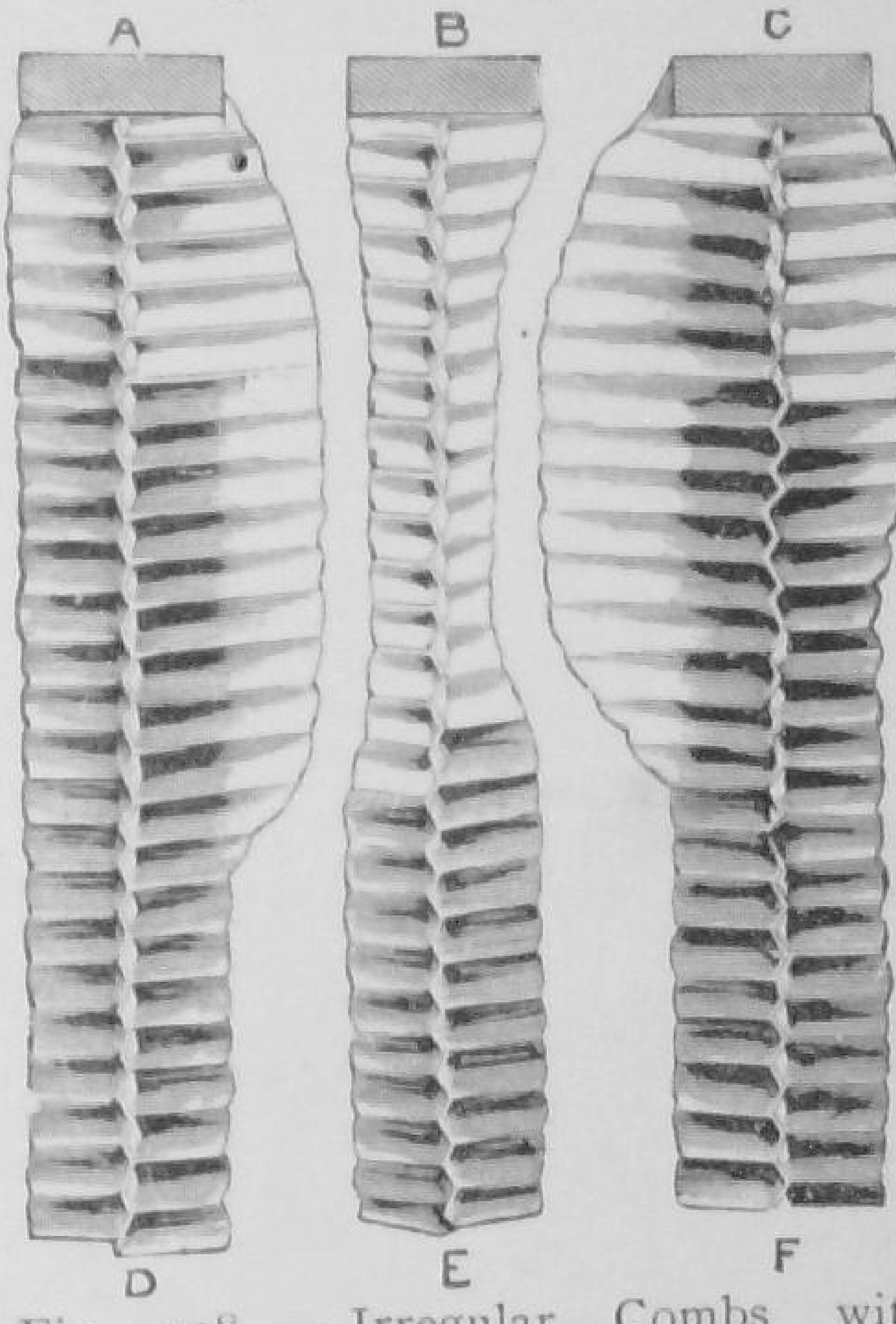


Fig. 108. — Irregular Combs with Extended Cells.

A B C, top-bars; D E F, midrib of comb.

Driven bees are also useful in building up nucleus colonies formed from stocks which swarm late in the season. In these cases the young queens are hatched so late that sufficient bees for safe wintering cannot be raised before breeding ceases for the year. Such colonies may be made safe and strong by adding a few pounds of bees in the autumn, on the plan followed in "Uniting" (see page 105). Weak stocks headed by failing queens can have their vigour and prosperity

renewed by adding driven bees from a skep that has swarmed during the current season, as they will be accompanied by a young queen. Directions for this case will also be found in the instructions referred to above.

XXXII.—UTILISING DRIVEN BEES.

Within the last few years a custom has been in general use of building up stocks in autumn from driven bees, which at that season may be had from skeppists who formerly used the sulphur-pit in destroying their bees in order to obtain the honey.

The superstitious fear prevailing among skeppist bee-keepers of the old school that bad luck must follow any taking of money in exchange for bees is now happily a thing of the past, and, in consequence, condemned bees are so plentiful in some districts that experienced bee-keepers find it worth their while to make long journeys in autumn buying up bees for driving, for which they find a ready sale among bee-keepers desiring to increase their apiaries by building up new colonies from driven bees. But apart from the question of increasing stocks, many bee-keepers undertake similar periodical trips with the double purpose of obtaining bees to strengthen weak colonies, and of infusing new blood and fresh vigour into their apiaries by young queens and bees so obtained. In expeditions of this kind some special equipment is necessary for the safe transit of the driven bees. Fig. 109 shows a method of carrying bees in skeps on a bicycle, and Fig. 110 explains the arrangement by means of which the skeps are secured for the journey homeward. In the words of the originator of this method, " the attachment consists of a cross-frame made up of $\frac{1}{4}$-inch gas-pipe. At centre of the cross is a

four-way piece, into which the members are screwed. The long end of the cross is passed through the saddle-pillar and fastened with a nut on the front end as sketch. Under the points A A two spikes about 1 inch long project, which prevent the skeps working along

Fig. 109.—Carrying Driven Bees on Bicycle.

towards the wheel and thus running danger of getting the cheese-cloth rubbed into holes. The top skep is fastened on with ordinary wire driving-irons, except the front one, which has one of the points turned at right angles to its former position, and bent up to hook

round the pipe. This one is used next the saddle. The other three are used by sticking one point into each end of the tube, and the other into the skep, taking care to press the skep well down before pushing the point into the straw. The skeps to be used at the side have stout string loops sewn in about 90 deg. apart, and in fixing these a long piece of string is used. This is first tied to the pipe which projects to the side on which the skep is to be fixed, then through first loop and round the back fork and back through loop, on to the next loop and round back fork lower down; then right round skep and fasten to pipe again. If tightly tied the skeps will travel quite safely, and the two bottom ones stiffen the whole thing, making it travel with very little rattle. The whole apparatus need not cost more than 2s. 6d. to 3s."

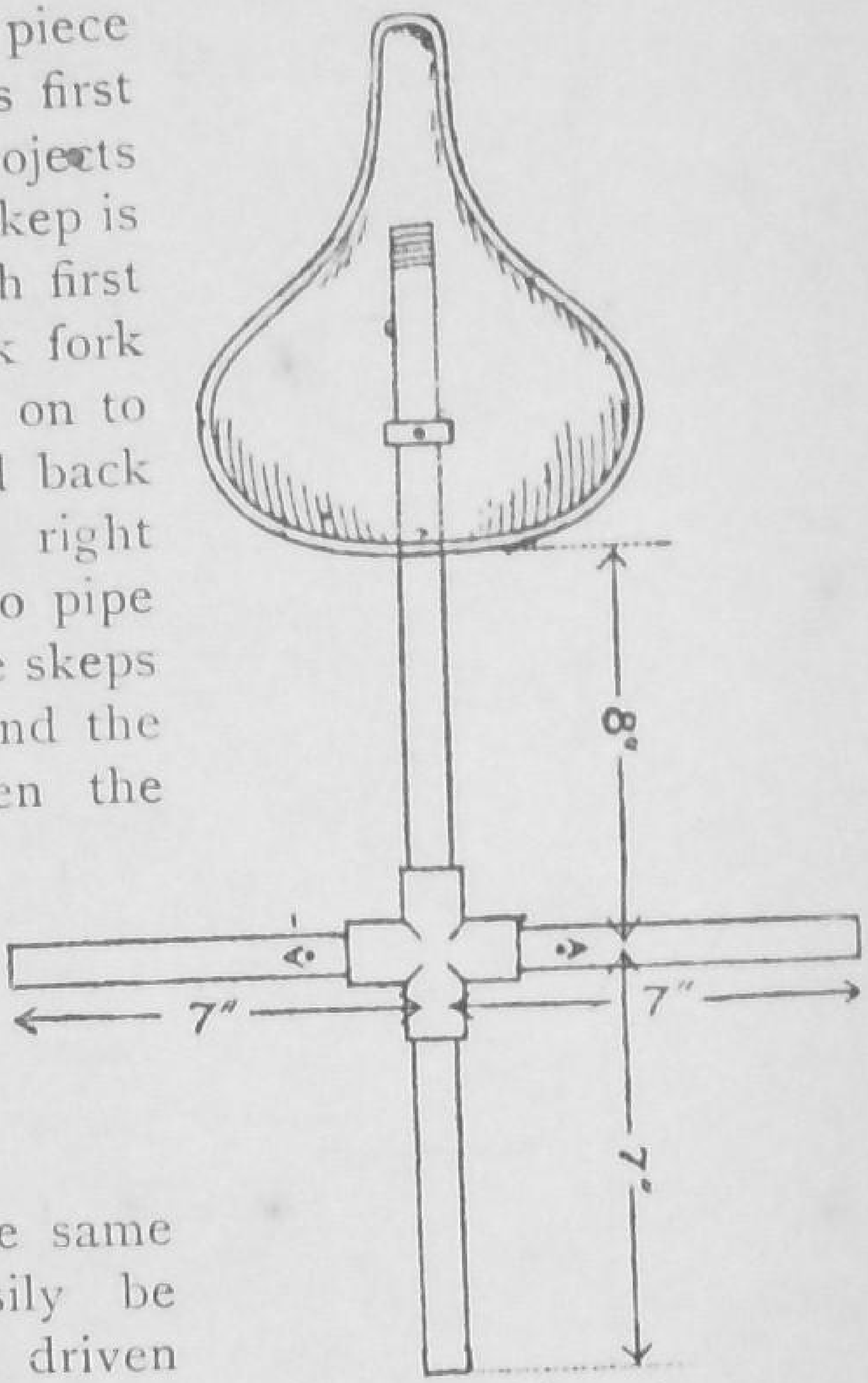


Fig. 110.—Carrying Device.

An adaptation of the same attachment could easily be made for carrying the driven bees in light boxes, costing about one penny each, of about equal holding capacity to an ordinary straw skep. In preparing these for use, cut a hole 7 inches by 4 inches in bottom of box and also in the lid; next nail strips or battens of wood $\frac{3}{4}$ inch square on outsides of box bottom and lid; then cover the holes *inside* with per-

forated zinc. The bees as driven are run into the box by propping up the front, and, when all are in, lift the box on to the lid, turn the whole carefully over, and tie or screw on the lid—the latter for preference. Thus dealt with, eight or more will pack safely on a bicycle for the home journey.

Fig. 111.—Carrying Driven Bees in Bags.

Another and very good plan for carrying driven bees is shown in Fig. 111. In this case bags are used for holding the bees, and are made of strong, coarse muslin or mosquito netting. The mouth should be wide enough to go round a straw skep. A small hoop

is fixed at the other end to keep the sides of the bag apart. The bees are "driven" into an empty skep, then the mouth of the bag put over the open end of skep, and a sharp jerk transfers them from skep to bag. A quick separation of bag and skep follows. The bag is then "sacked up," securely tied, and is then ready for a repetition of the operation with another lot. Three and even four lots may be put in one bag in this way, and there is no trouble about uniting. If the bees are not all driven cleanly, hang the bag upon a bough open, and the flyers will rejoin their comrades in a few minutes. A brass ring or hook is sewn to the top of bag (opposite end to mouth), which slips along a stiff bamboo rod lashed to bicycle handles (see Fig. 111), and these may be added to as desired.

This method of carrying driven bees was devised by Mr. E. H. Bellairs, hon. secretary of the Hants and Isle of Wight B.K.A., who is seen in Fig. 111 along with his son. They have carried nearly twenty driven lots of bees a distance of ten miles in this way.

Two or three lots of driven bees joined together in a hive containing frames of comb will, if liberally fed after hiving, generally make a strong colony.

XXXIII.—ARRANGEMENT OF AN APIARY.

Hive entrances may face in almost any direction, yet south or east is preferable. The morning sun shining on the hive-front induces the bees to begin work early. Protect them from the north and west winds, if possible by a hedge. Do not crowd the

hives together, but have each on a separate stand, placing them four to six feet apart. The stands should be low, with an alighting-board sloping towards the ground. Without this a great many bees returning to their hives loaded in the spring are blown underneath, becoming chilled, and not rising again. Keep the ground clear of long grass and weeds, so that if a queen falls off the comb when frames are being examined she may easily be found. Have a path, if possible, at the back of the hives—which should always be opened and examined from the back—thus causing little interruption to the flight of bees passing in and out.

Fruit-trees planted near hives will not only afford the bees shade, but yield an early supply of honey and pollen. For the production of honey none can excel apple, pear, and cherry trees, which at time of blooming are quite surrounded by bees. A modern apiary in a Kent orchard (page 160) illustrates the usefulness of shade both for bees and bee-keeper. Raspberry, whitethorn, and snowy mespilus (*Amelanchier canadense*), a hardy deciduous shrub bearing a profusion of blossoms in early spring, yield an abundance of white honey of a delicious flavour, and are therefore of great value to the bee-keeper. White clover, however, is by far the most important source from which bees derive their supplies. It yields large quantities of very pure white honey of superior flavour.

Many other honey-producing plants could be named, blooming at different seasons, as all single blossoms, with few exceptions, produce either nectar or pollen. Some of the principal are sainfoin, lime-trees, alsike clover, buckwheat, mustard or rape, cat-mint, figwort, phacelia, borage, &c. Near the hives may be planted crocuses, Limnanthes Douglasii,

Modern Apiary in a Kent Orchard.

arabis, wallflowers, and other spring-flowering plants, as these all afford the bees early pasturage. There should be a shed or building close to the apiary, where hives and apparatus can be kept, and where the honey may be extracted and stored ready for sending away.

It is a great advantage if the bee-keeper is located

Fig. 112.—*Calluna vulgaris* (Common Ling).

Fig. 113.—*Erica cinerea* (Bell-heather).

within the reach of heather, which forms a second harvest after the above are done with. Figs. 112 and 113 represent the two sorts of heather on which bees work. The common ling (*Calluna vulgaris*) is by far the better of the two, honey from it being always saleable at a good price.

XXXIV.—ROBBING.

Bees seldom rob when forage is plentiful, or when, by the management of an able bee-keeper, precautions are taken to guard against it. When honey is scarce in the fields any exposure of sweets to bees will induce robbing, and once accustomed to plunder they will try to enter every hive in the apiary. A strong colony will sometimes attack and destroy several weaker ones, and carry off all their stores.

When a hive is being robbed an unusual agitation of the bees near the entrance may be noticed; they keep up a constant buzz, and rapidly enter the hive when they alight; bees will be seen to run towards their enemies and quickly drag them away; fighting may also increase, and many be killed. Bees always defend themselves unless weak or queenless, and such colonies must be carefully protected. If robbers are found actively at work, close the entrance so that only one bee at a time can enter. If this does not quickly stop it, the hive should be entirely closed till sunset, taking care to provide sufficient ventilation. Sometimes it requires all the bee-keeper's patience and skill to stop robbing, more especially if it has been going on for some time unnoticed.

When robbing has commenced, place a piece of window-glass 8 by 5 inches in front of the flight-hole, the top resting against the hive, and the lower end about $1\frac{1}{4}$ inches from the entrance, on the alighting-board, to allow the bees of the hive to go in and out at the sides. The robber bees, going straight at the entrance, are stopped by the glass, which can be removed after a few days.

In cases of persistent onslaught of robbing, which are very difficult to subdue, a folding tent like that

shown in Fig. 114 overcomes the difficulty when slipped over the hive attacked, the robber-bees being imprisoned, and it completely prevents further attack. The bees within the tent can be released towards sun-

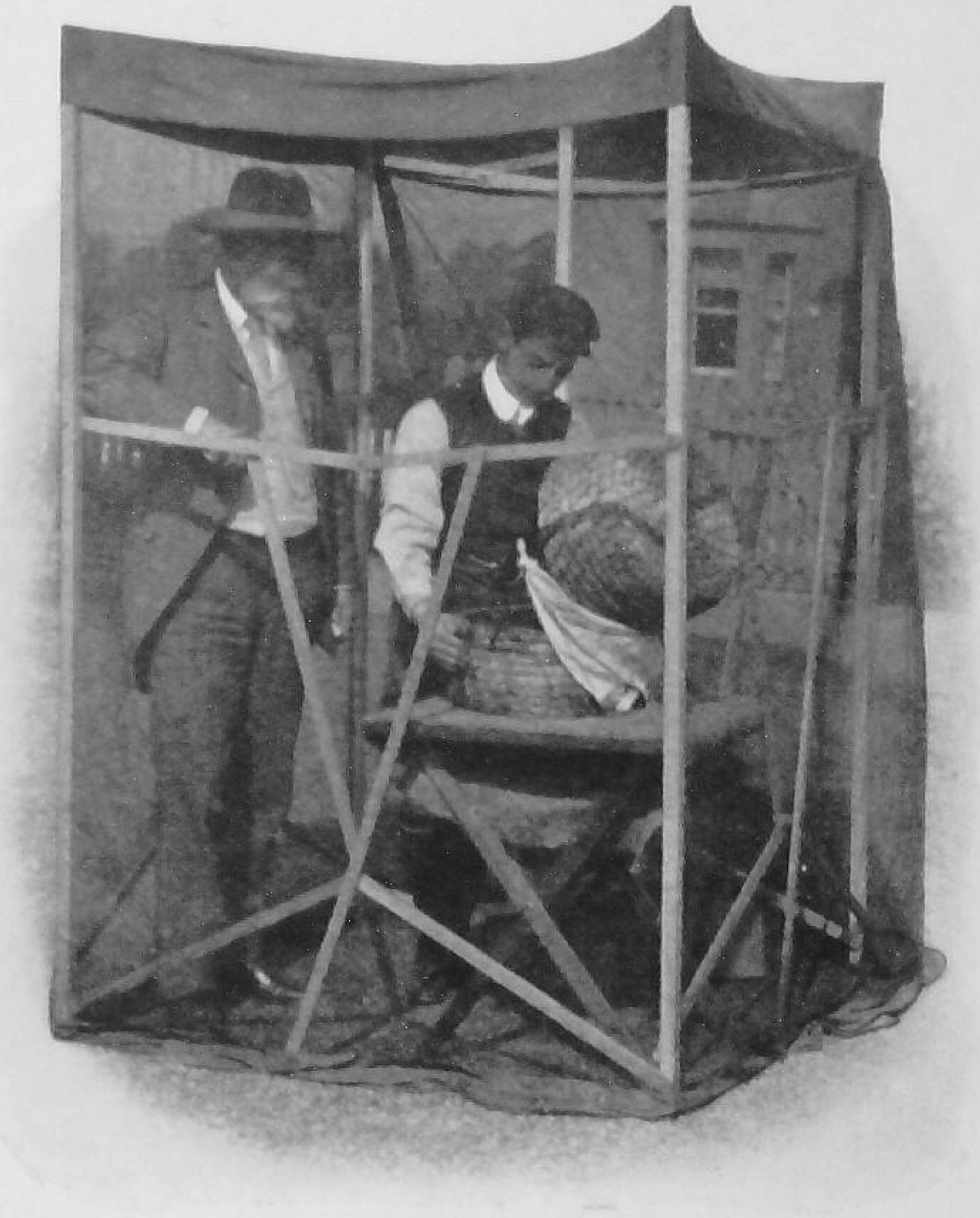


Fig. 114.—Guarding Against "Robbing."
(Holding an exam. amid a hundred stocks of bees.)

down, and the tent placed over the hive again until the trouble is over. The same result is easily attained by using the claustral chamber (see page 50).

I have used successfully a rag moistened with carbolic acid, hung on the front of the hive just over the entrance, and the Rev. G. Raynor recommended a cloth sprinkled with carbolic solution, as described on page 101, laid upon the alighting-board. The cloth is replaced every morning, and sprinkled or sprayed with the solution several times a day in bright weather.

The tendency to start robbing should, however, be guarded against by leaving no sweets exposed, by uniting weak stocks, and keeping all colonies strong.

Up to a recent date trouble from robbing was usually prevalent in the autumn, when removing the

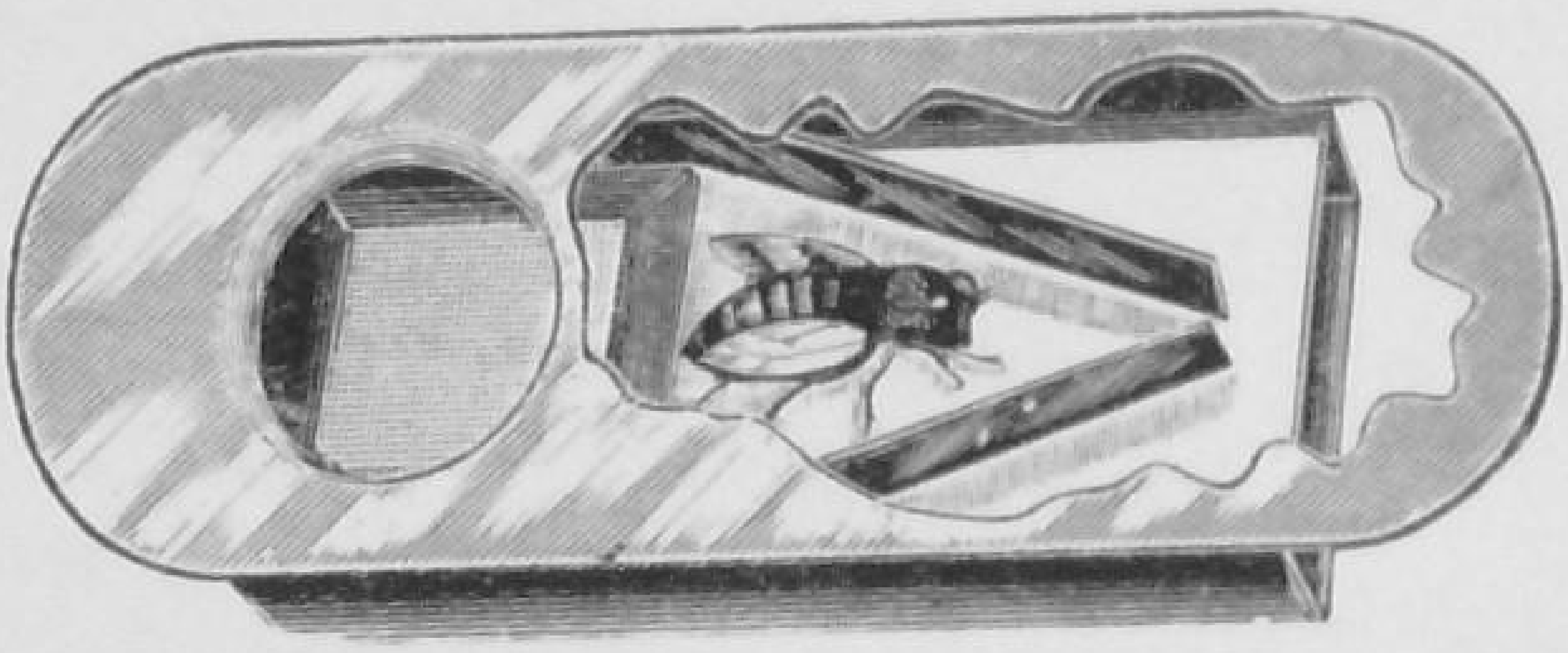


Fig. 115.—"Porter" Bee-escape.

final surplus for the year, or, more frequently still, when getting boxes of combs—wet after extracting—cleaned up for storing. This evil has, however, been almost entirely done away with by the use of the super-clearer (Fig. 36, page 58), fitted with the "Porter" bee-escape (Fig. 115). This appliance, properly used, keeps the bees quiet, and is altogether helpful for the end in view (see page 58).

An outbreak of robbing may, if taken in time, be checked by sprinkling the bees and the whole of the hive-front with carbolised water from a fine-rose watering-can. A few drops only of carbolic acid are needed, just sufficient to scent the water.

XXXV.—ENEMIES OF BEES.

Wax-Moth.—This moth, *Galleria cerella* (*cereana*), hatches from an egg laid either in or close to the interior of the hive by a winged insect, which may be seen late of a summer evening flying near its entrance. During the day the female moth (Fig. 116, B) may be found concealed in the vicinity of the hive, and if admittance be gained she will deposit a large number of eggs in some crevice containing the litter of the hive, which affords the young worms their first food and protection. Sometimes the eggs are deposited in empty combs, or combs not covered by bees. As soon

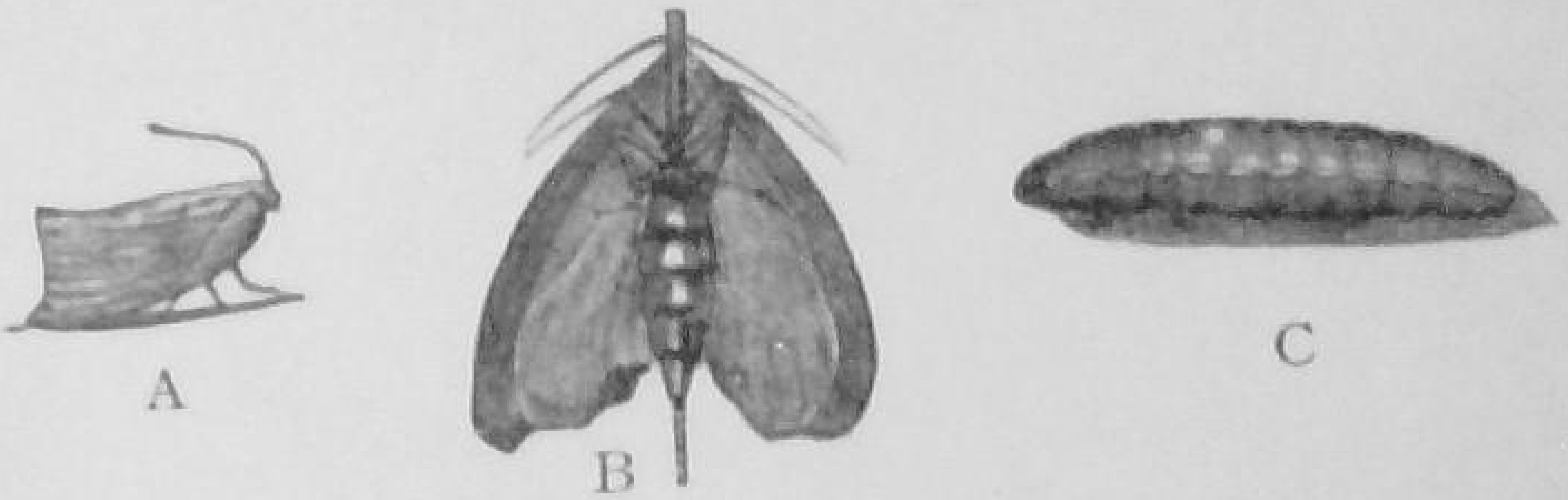


Fig. 116.—The Wax-moth, *Galleria cereana* (natural size). A, male; B, female; C, larva.

as the worm hatches it begins to eat wax, pollen, and brood, spinning passage-ways of a tough, silky film in the direction of its movements. After three weeks the worm has attained its full growth (about 1 inch), and then seeks a crevice or other secure place wherein to spin its cocoon, prior to emerging a perfect winged moth. In Fig. 117 the cocoons are seen on a comb in which the moth has secured firm lodgment. The usual indications of the presence of the moth in a hive are fragments of wax mixed with black specks, resembling gunpowder—the excrement of the grub. If hives are kept strong in bees the wax-moth need not be feared,

because of its small chance of effecting an entrance, but when neglected the moths take complete possession of the combs, reducing them to a mass of entangled webs and débris, as shown in Fig. 117. Care should be taken not to leave old combs about, or in empty hives with entrances left open. If not melted

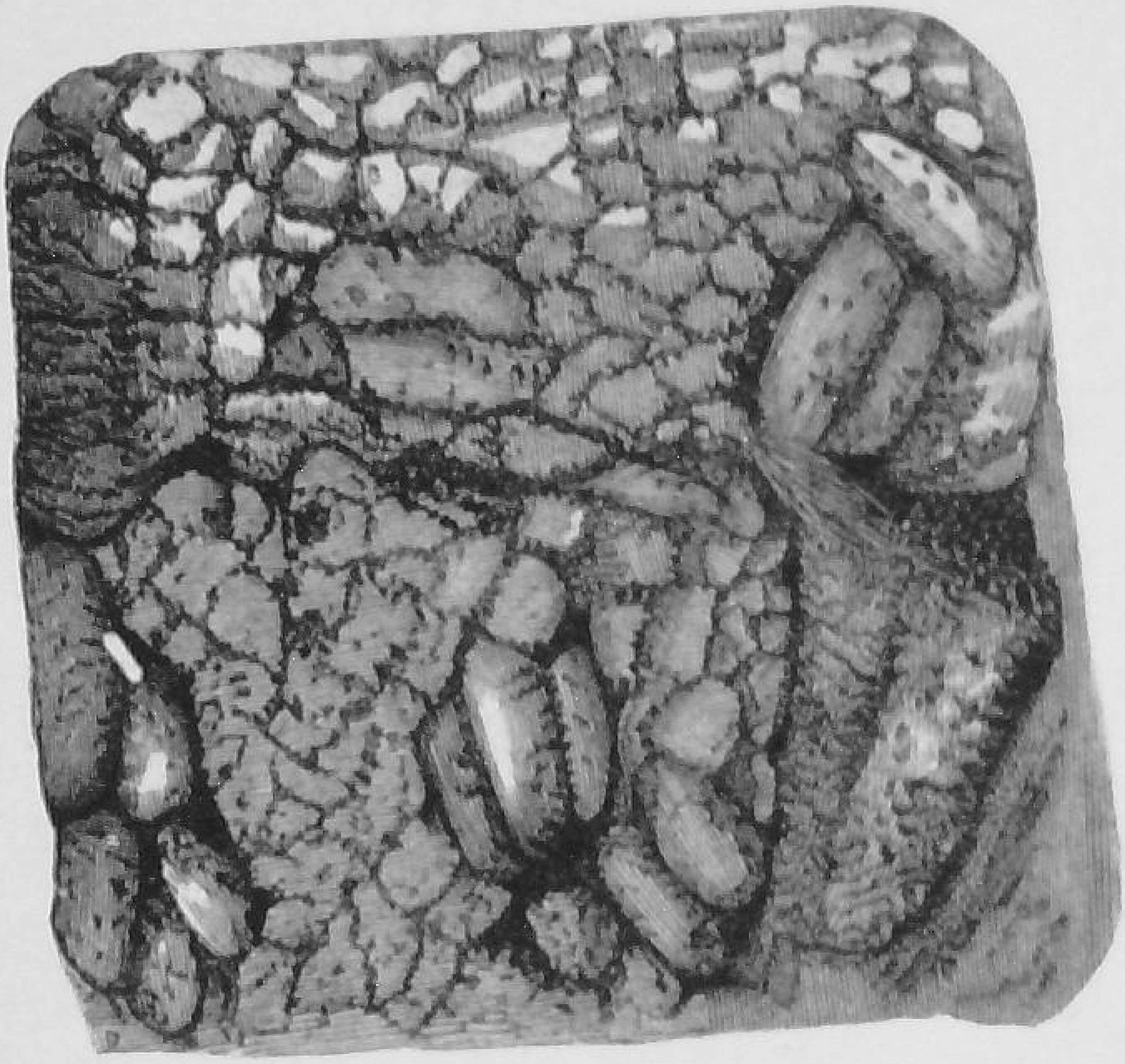


Fig. 117.—Combs Destroyed by Wax-moth.

into wax they become a nursery for moths, which will in their turn seek to enter hives when able to fly.

A smaller moth (*Achroia grissella*) causes some trouble at times by depositing its eggs in the saw-scarf of top bars; but strong stocks are well able to keep this enemy at a distance, and the bee-keeper, by destroying the larvæ when seen, is able to cope with

this trouble. By watching the entrances at sundown many moths seeking admission may be destroyed.

Wasps.—In some seasons wasps are very troublesome, more especially towards the end of summer. At this time the entrances should be narrowed, to give the bees a better chance of protecting themselves against the superiority in strength and greater activity of the wasps. In the spring destroy all queen-wasps, as each of these starts an independent colony. Nests may be destroyed by pouring in at the entrance a cupful of gas-tar, turpentine, or paraffin, and then stopping it with earth or a good-sized clod. Bottles partly filled with sweetened beer, placed near the hives when wasps are very troublesome, will catch many of them.

Another way: If the nest is in a suitable position, it may be got rid of by preparing a squib of moistened gunpowder fixed on a stick about 10 inches long. This done, and the entrance to the nest clearly ascertained, light the squib and immediately thrust it in, blocking up the space round the stick, and with a spade or old chisel the nest may be dug out, and the combs of brood and stupefied wasps destroyed before the latter have time to recover.

Mice will enter hives if they find an opening large enough to admit them, and sometimes do great damage to the combs, besides eating honey. These intruders, however, are effectively kept out if the hive-entrance is only $\frac{3}{8}$ths of an inch high. Placing $\frac{1}{4}$-inch mesh wire-net in front also keeps them out.

Spiders should not be allowed to exist in the vicinity of the hives, as they catch bees in their webs.

Birds.—The great tit (*Parus major*) is always ready

to feed on bees, and in winter, when snow is on the ground, will sometimes be seen on the alighting-board of a hive occasionally tapping it with its beak. The noise brings a bee to the entrance, when it is promptly snapped up. The blue tit (*Parus cœruleus*) also feeds on bees; but the greatest enemy of all is the butcher-bird, or red-backed shrike (*Lanius collurio*), which seems to kill for the pleasure of killing, and has the singular habit of impaling its victims on thorns and twigs, and in that position tearing and devouring their carcasses piecemeal. If tits are numerous, a net placed over the hive will prevent their getting on to the alighting-board.

Ants are sometimes very troublesome; they crawl into the hives, and often carry off large quantities of stores. There are several ways of getting rid of them. Leaves of tansy or black walnut keep them away, as will turpentine rubbed on the stand and bottom of hive. Sprinkling powdered naphthaline between hives and outer cases and about the quilts is also effective. Hives on legs can have cast-iron shoes (Fig. 118) fixed to them. These serve the useful purpose of not only preserving the legs from decay, but the cup shown in the enlargement at the base, which, when filled with paraffin or other oil, effectually prevents ants from entering the hives.

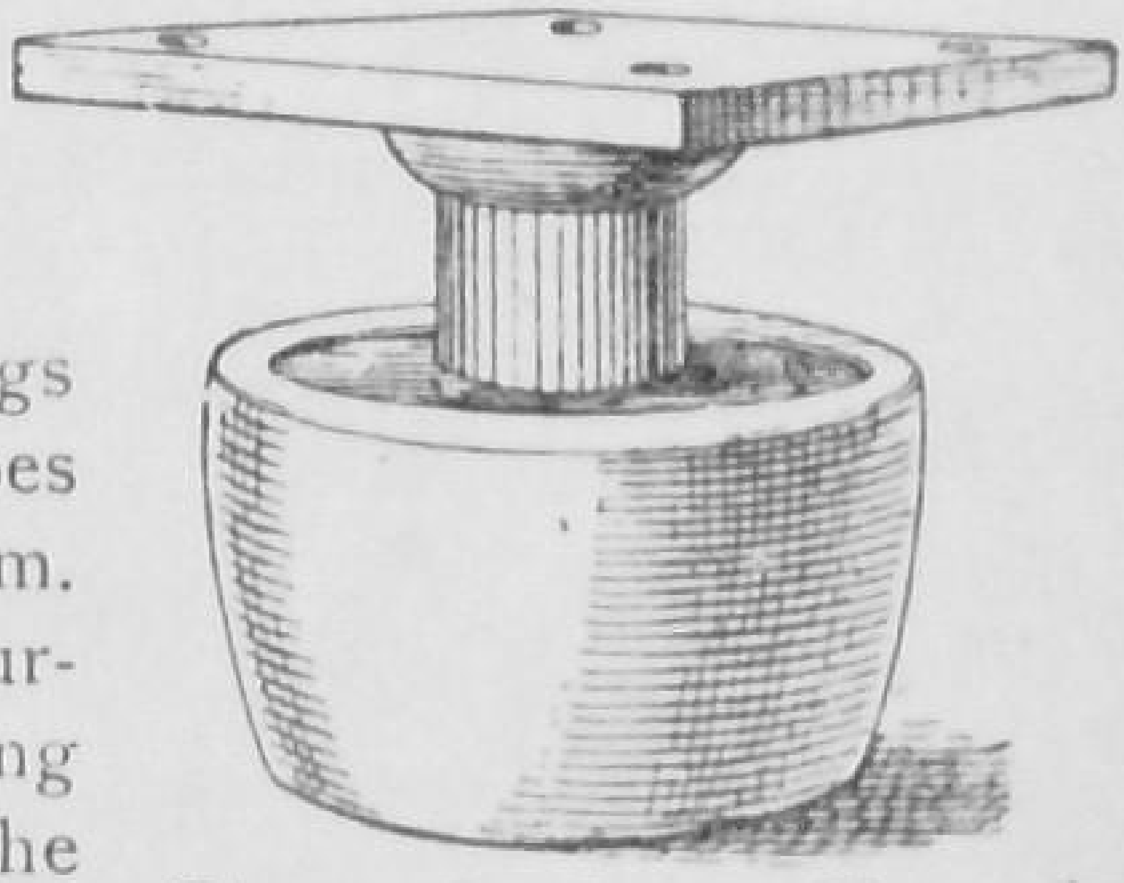


Fig. 118—Iron Shoe for Hive-legs.

Earwigs sometimes enter hives, and where numerous may be frequently found between the quilts

and in the cavities below frame ends. The iron shoe (Fig. 118) will prevent them, or other insects, from getting into the hives.

TOADS watch for bees returning to their hives, and frequently snap them up when they are blown to the ground in windy weather; hence the advantage of a large alighting-board reaching down to the ground, as the tired bees drop on to this, and then safely make their way into the hive.

BRAULA CŒCA, or blind louse (Fig. 119), is a small reddish-brown parasite which attaches itself to the bee, and is sometimes found in large numbers on the queen. It has three pairs of legs, and is difficult to catch, owing to its rapid movements. The eggs hatch inside the insect, and the larvæ are nourished by the secretion from a gland. The pupa is extruded on to the floor-board of the hive, and fourteen days later a perfect insect emerges. The natural size of this is shown in Fig. 119, A. The young lice remain on the floor-board until they have the opportunity of climbing on to a passing bee. They do not seem to do the bees any harm, and, although prevalent in the southern parts of Europe, usually die off in our climate towards the winter. Strong fumigations of tobacco will dislodge them, followed by cleaning the floor-board and washing several times with phenyle or carbolic solutions (Nos. 9 or 11, page 198).

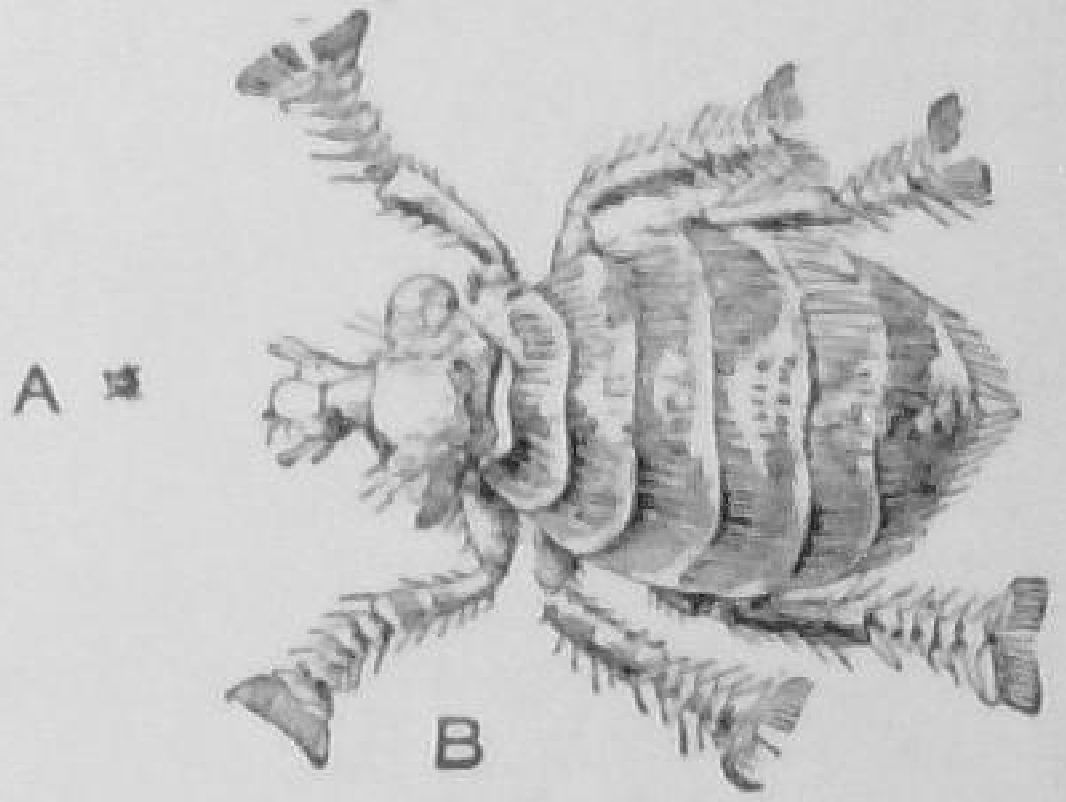


Fig. 119—*Braula cæca*, or Blind Louse.

XXXVI.—DISEASES.

Bees are subject to various more or less serious diseases, which may break out in the best-managed apiaries. Some of these are very contagious, and with the commerce in queens and bees that has been developed, it is not surprising that diseases should break out in districts hitherto exempt. It is sometimes very difficult to persuade cottagers and others to take drastic measures to exterminate disease when it appears, and any interference is resented. Such cases are common, and neglected hives prove centres of contagion. This is not to be wondered at, as bees live in colonies in close touch with each other, and carry all food either within or on their bodies. These facts create the best condition for the propagation of the numerous disease organisms revealed by the microscope; and, in consequence, the presence of so many bacteria, both pathogenic and otherwise, in colonies of bees is not surprising.

Foul brood (of which there are two types, a virulent and a mild one) and *Dysentery* were the most important diseases with which bee-keepers in this country had to contend until late years, but recently cases of what is known as *Black brood* have occurred, and another disease has visited the Isle of Wight and caused considerable havoc amongst the bees there.

Dysentery may be found in some hives during the latter part of winter and in the spring. The usual signs are: the bees discharge their excrement over their combs and hives—in fact, wherever they chance to be; the fæces are dark and muddy in appearance, with a peculiarly offensive smell; the bees are weak, slow

in movement, and decrease unusually fast. In a normal state bees never discharge their excrement in their hive, but in the open air outside. During winter frequent flights are impossible, owing to cold, consequently the products of digestion accumulate in the intestines. If bees consume only good honey, or thick syrup made from pure sugar, the products referred to above are insignificant, and confinement in the hive may be considerably prolonged without detriment to the colony.

Feeding on unsealed and fermented honey, with long confinement, during which the bees are from any cause kept abnormally active indoors, are generally the cause of dysentery.

Feeding bees late in the autumn on watery food, so that they are unable to seal their stores before winter, and badly ventilated hives, also tend to produce the disease. Syrup made from impure cane or beet sugar, brown or moist sugar, molasses or glucose, should never be given to bees, as they all increase the amount of excrement, and are liable to cause dysentery, especially if they are wintered upon such impure substances as are mentioned above.

On the other hand, if hives are properly packed for winter, and the bees fed up with good thick syrup and not disturbed, this disease need not be feared. But if a colony is attacked, give it a clean hive and floor-board, and exchange the soiled combs for clean ones. Feed the bees on candy, or give them a comb of sealed stores; supply proper ventilation, and disturb as little as possible.

The division-boards should be moved so as to reduce the size of the hive to the number of combs covered by bees; this done, protect the hive well from cold.

Foul brood, or *Bee-pest,* has, no doubt, been known

as a bee disease for centuries. Schirach, who seems to have been the first to give the name of "foul brood" to the disease, mentioned and described it in 1769, and recommended starvation as a remedy. Its true nature was discovered by Dr. Cohn in 1874, who pronounced it to be caused by a bacillus, to which Cheshire and Cheyne in 1883 gave the name *Bacillus alvei*, by which name it has since been known in this country.

It was at one time supposed that only the brood or larvæ were attacked by the disease, hence the name "foul brood." But Hilbert's investigations in 1875 enabled him to declare it not only a disease of the brood, but that mature bees—sometimes including the queen—were liable to be affected by it. Thus the disease is sometimes called "Bee-pest." Two types of foul brood are recognised—a virulent, vile-smelling one, difficult to cure, and a mild or odourless form, which is much easier to cure. Both kinds are contagious.

Healthy brood in the combs lies in compact masses (Fig. 7, page 16), the larvæ being plump, of a pearly whiteness, and when quite young lie curled up at the bottom of the cells much in the form of a C. When a colony is attacked, as the disease develops the affected larva begins to move unnaturally; and, no longer plump in appearance, it becomes extended horizontally in the cell, and has a flabby aspect, which indicates death. The colour now changes to pale yellow, afterwards turning to brown; the dead larva then begins to decompose, and eventually shrivels up, leaving nothing but a dry brown scale, which adheres to the side of the cell.*

When the larvæ die after the cells have been sealed

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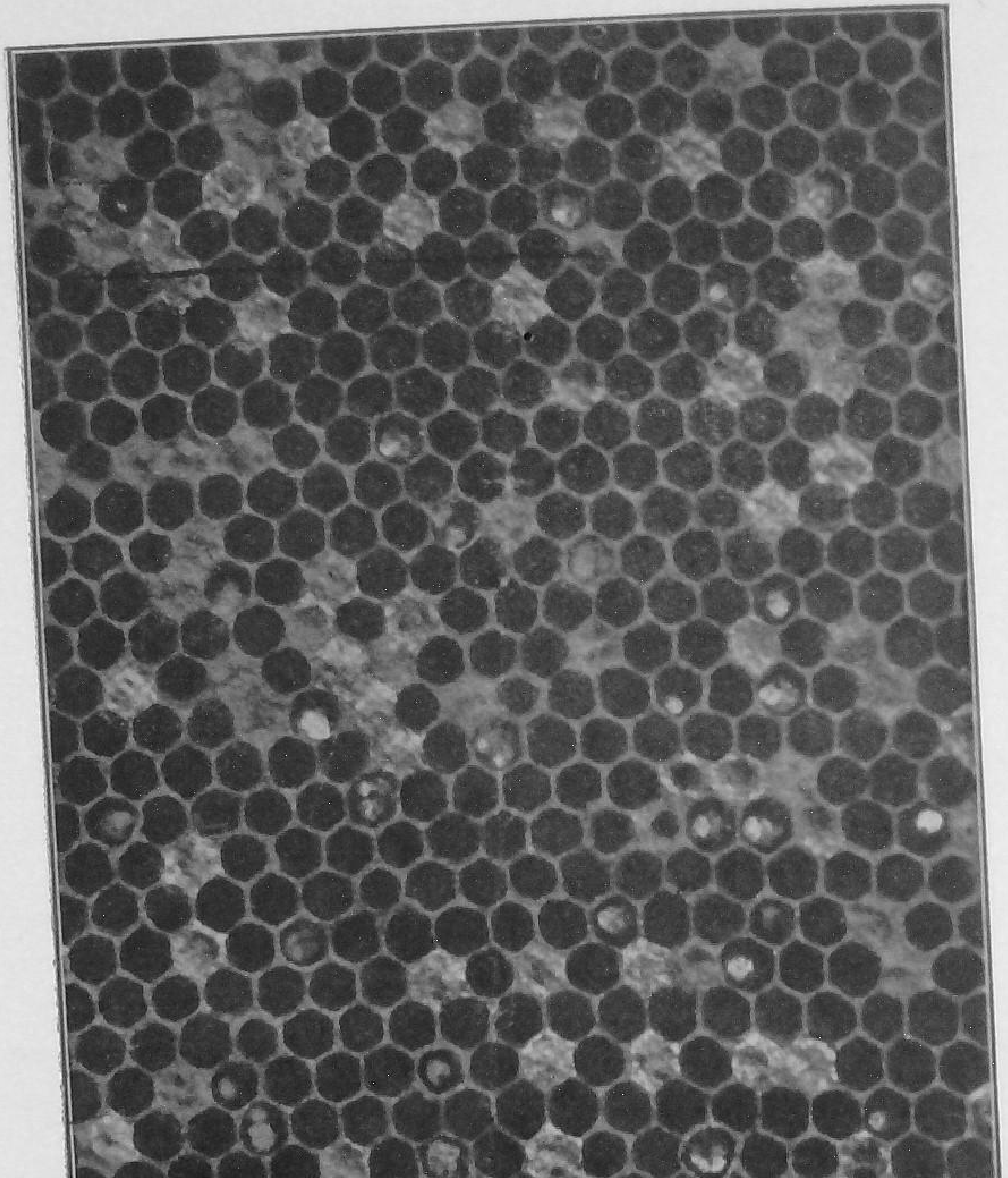
* Note.—Chilled brood is frequently mistaken for foul brood, but the characteristics are different and should be noted (see "Chilled Brood," page 185).



Foul Brood, *Bacillus Alvei*.
Untouched photo (from Nature).

over, cappings here and there are seen indented and darker than those of healthy brood. The cappings, too, are often perforated with irregular holes, as seen in the illustration on opposite page. On inserting the end of a match in one of these cells, it will, on withdrawal, have adhering to it—as a putrid, ropy, tenacious, coffee-coloured mass—all that remains of the tracheæ (which do not decompose) of the dead larvæ,

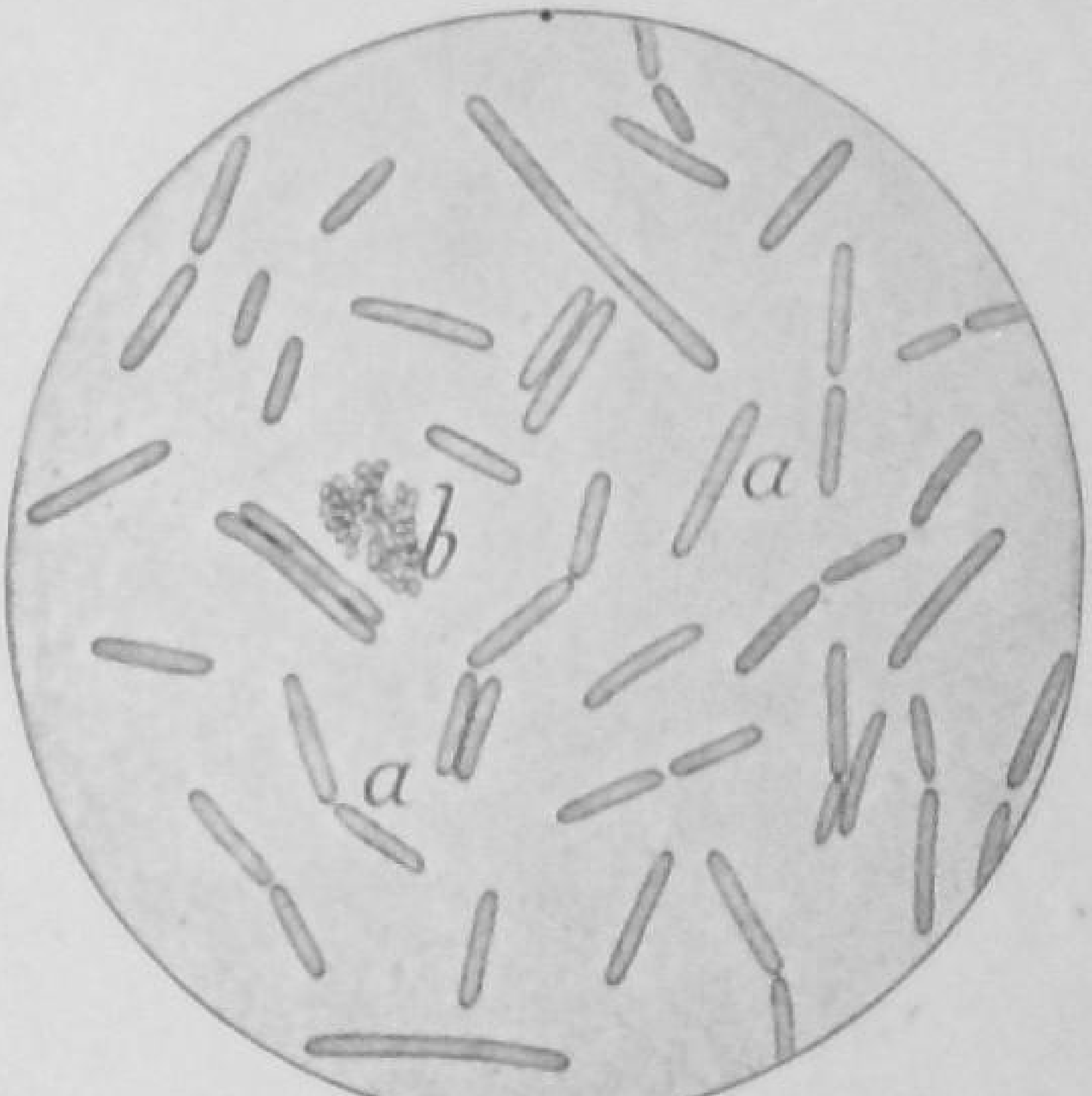


Fig. 120.—*Bacillus alvei* (rod condition).

which can be drawn out in a fine thread before it breaks, and, in the virulent form of the disease, emits a most disagreeable stench. Eventually this mass dries up, as explained above. Later on the bees become inactive, losing much of their desire to fly abroad; they will also be seen fanning at the hive-mouth, from which in very bad cases the disagreeable odour mentioned is emitted. In the mild type of the disease there is no bad odour, the other symptoms being similar, but more of the

larvæ die still unsealed while they are curled up at the bottom of the cell, rotting and drying up to a dark-greyish crust, which is easily removed.

Until recently it was supposed that *Bacillus alvei* was present in both forms, but the researches of Dr. Burri, of Zurich, and Dr. Maasen, of Dahlem, recently published, tend to show that in the odourless form other bacilli also take part in promoting the disease, one very difficult to cultivate, and another very rarely

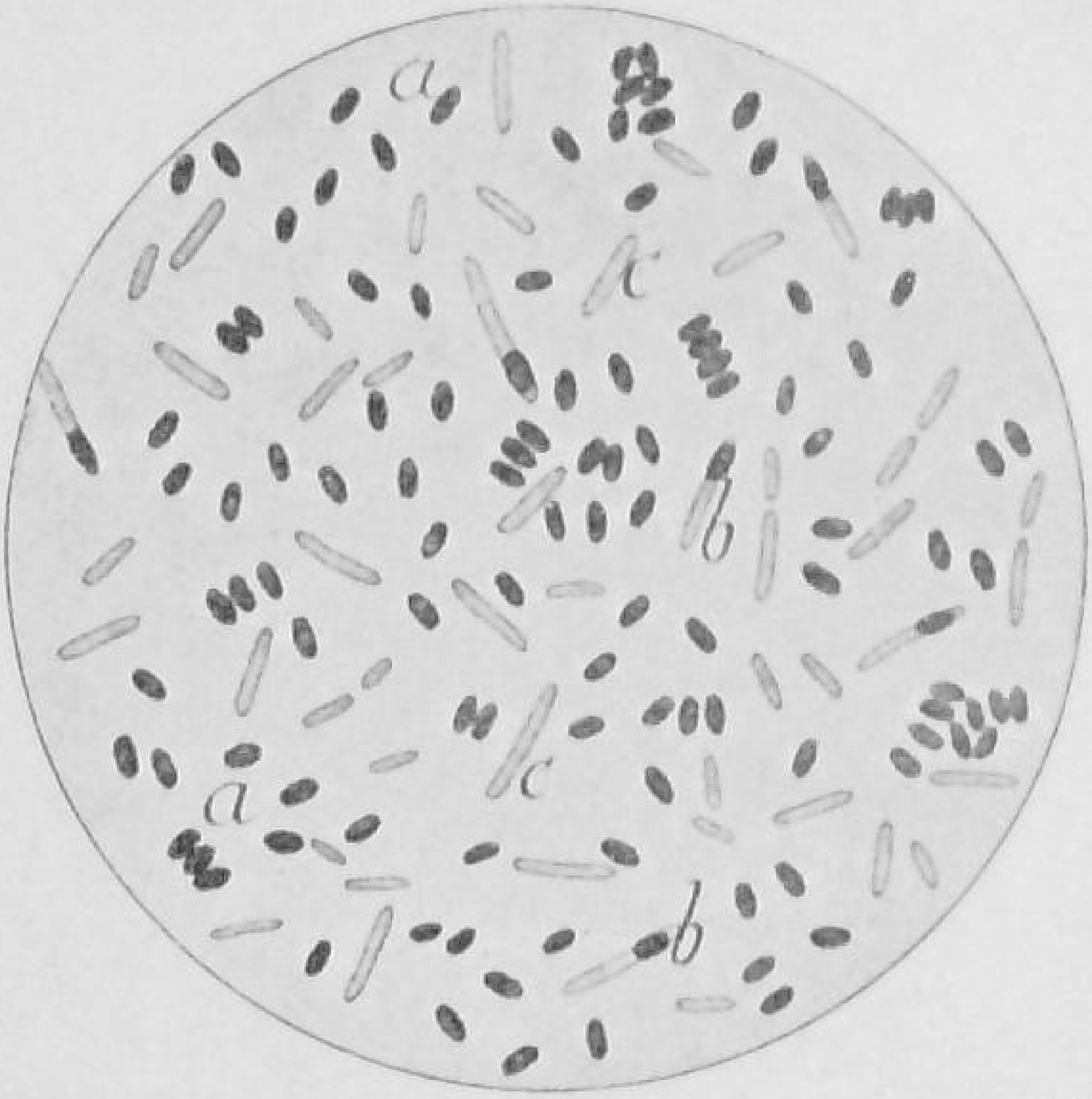


Fig. 121.—*Bacillus alvei.* Rods, Spores, and Spore-formation.

present, but easily cultivated. One of these is *Bacillus Burri,* and is probably the same as the one that has been named by Dr. Maasen *Bacillus Brandenburgiensis Maasen;* the other is yet unnamed, and is possibly the cause of black brood (page 182).

Fig. 120 shows *Bacillus alvei* in the rod condition, from a specimen of virulent, strong-smelling foul brood, Fig. 121 representing a later stage

of the disease, where both spores (*a*) and rods (*c*) are present, some of the rods (*b*) being seen in the process of changing to spores. In Fig. 122 we have the rods of odourless foul brood (*Bacillus Burri*), showing very distinctly the flagella by which their movements are effected.

The bacteria of sour brood are frequently found in company with *Bacillus alvei*, as in (*b*) Fig. 120 (see page 183).

Fig. 122.—*Bacillus Burri*. Rods of Odourless Foul Brood.

Dr. Maasen, of the Imperial Biological Institute, Dahlem, in his report of the investigations carried on during 1906, states that in sixty-six out of sixty-seven specimens of foul brood sent to the Institute he found a microbe belonging to another family of the higher bacteria. To this he has given the name of *Spirochæte apis Maasen*, and it is shown in Fig. 123, enlarged one thousand times.

Respecting the particular pathogenic or disease-producing micro-organisms with which we are obliged to deal in foul brood, viz., *Bacillus alvei* or other *bacilli*, we have to contend with them in two different forms and stages of life, in one of which—representing the earlier stages of the disease—the vitality of the organism is easily destroyed; while in the other, the same organism, but under a different form, is capable of retaining life, and germi-

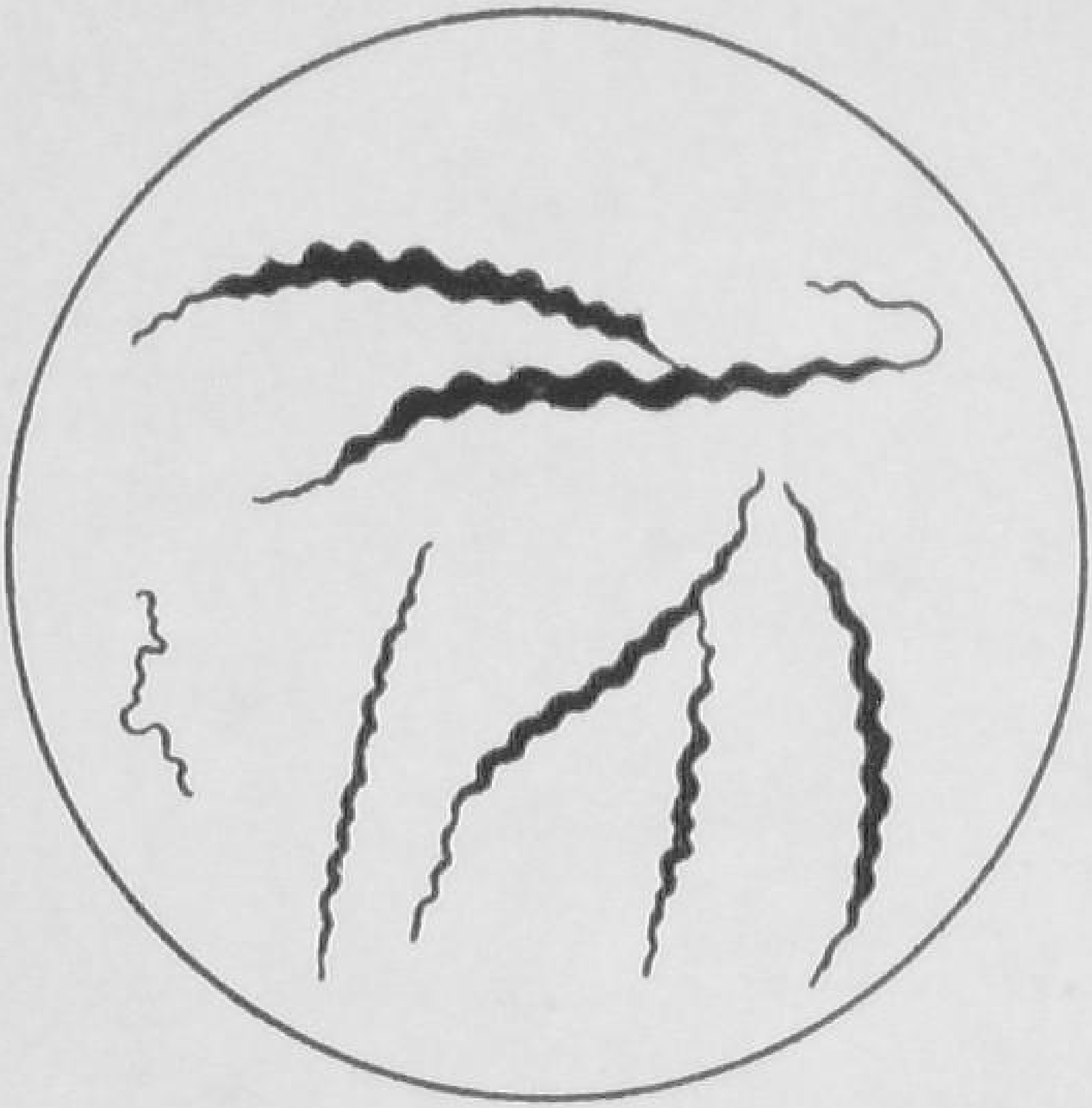


Fig. 123.—*Spirochæte apis Maasen.*

nating into the condition of the previous stage, even after what would appear the most damaging influences, such as long lapse of time, drying, heat, cold, and chemical reagents. The bacillus condition is the first stage of active life of these organisms; and it remains in this state, splitting and multiplying, so long as it has nutrient material to live upon and other conditions are favourable. A bacillus is rod-

shaped, and when, in process of time, it has attained full growth, it splits in two, each of these taking up an independent existence, and going through the same process; and as it is known that as many as two generations can be raised within an hour, and as the same rate of progression can be kept up by each individual in suitable nutrient media, it is not astonishing that foul brood spreads rapidly. Now, while in this bacillus stage, it is not difficult to kill the organism, and there are a number of chemical reagents, such as carbolic acid, phenyle, thymol, salicylic acid, naphthol beta, and perchloride of mercury, which, even in great dilution, will prevent the growth of bacilli. But in dealing with the microbe in the subsequent stage of its existence, the case is entirely different. When the bacilli, or rods, have multiplied to such an extent as to exhaust all the nutriment upon which they were feeding, or come in contact with surroundings inimical to their existence, the rods gradually turn into spores (Fig. 121), and this generally takes place in the latest stages of the disease. It is when this condition has been reached, and the rods have become spores, that the great danger arises, because of the difficulty in making many bee-keepers understand the difference between them and the bacilli. The spores are analogous to the seeds of plants, but differ from these in possessing greater vitality, for they not only retain the power of germinating into bacilli after a long period of time, but will endure heat, cold, drying, and

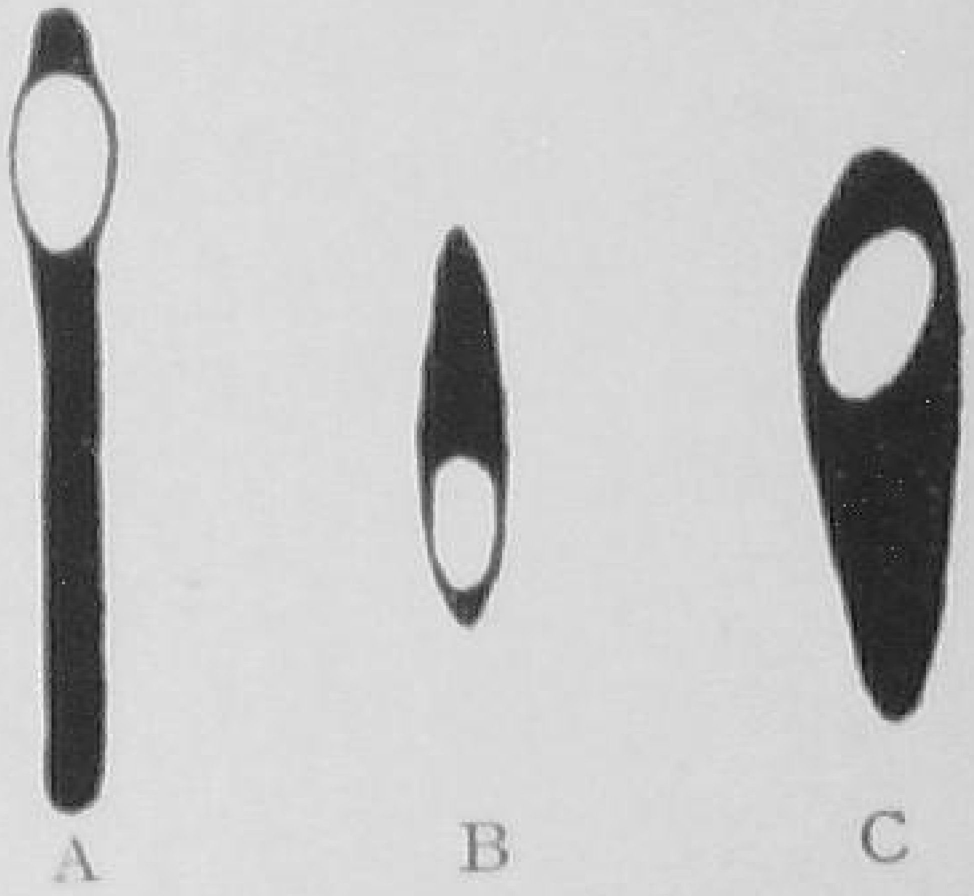


Fig. 124.—Characteristic Spore-formation of Various Bacilli.

chemical reagents, any of which influences would be destructive to bacilli themselves.

In Fig. 124 are shown the microscopical differences and relative sizes of spores in process of formation, found by Dr. Burri. These are magnified 3,700 times, A being *Bacillus alvei*, B *Bacillus Burri*, a new bacillus, difficult of cultivation, and C the rare but easily cultivated kind.

The great resistance of spores to high and low temperatures, to acids and other substances, is due to their being encased within a thick double membrane.

There are certain antiseptics which evaporate at the ordinary temperature of the hive, and whose vapours, while not actually killing the bacilli, arrest their increase or growth; among them may be named carbolic acid, phenyle or creolin, Izal, eucalyptus, camphor, naphthaline, &c.

As we have seen, bacilli are present in the earliest stages of the disease; but in the latest—when the whole rotten mass has become coffee-coloured or has dried up to a scale—they turn to spores. As the nourishing material becomes exhausted only spores remain.

It will now be understood that, owing to the great resistance of the spores, chemical substances have no effect at all upon them, and do not become germicides, unless administered under such conditions as would destroy the bees. From this it will be seen how great is the difficulty in curing foul brood unless the disease is attacked in its earliest stages.

It has previously been stated that adult bees are sometimes attacked by the disease. Such bees leave the hive to die, whereas the infected larvæ remain in the cells, unless disinfectants to arrest decomposition are used, in which case the bees remove them from the hives. Although many theories have been advanced, the causes of the disease are not yet clearly known.

Experience has, however, plainly shown that with foul brood—as in all epidemic diseases—the weak, sickly, and badly-nourished are attacked, and become centres of infection to others, and as colonies become weak, bees from healthy hives rob them of their honey, and thus carry off the germs of the disease along with their ill-gotten gains. The bee-keeper even may himself be a cause of spreading the pest by indiscriminately manipulating first diseased and then healthy hives, without taking proper precautions to disinfect himself or his appliances. Combs which have contained foul brood retain the spores. The queen lays eggs in the cells, and the workers deposit their honey and pollen in them. Both honey and pollen in this way become vehicles for transporting disease to the larvæ in process of feeding these by the nurse-bees.

The owner of a movable-frame hive can, by the facilities it affords of examining the combs, at once detect the disease in its earliest stages, and adopt measures for arresting its progress or for stamping it out altogether.

If, on examining combs, we detect the first symptoms of foul brood, as already described, the further progress of the disease can, at this stage, be arrested by feeding the bees with syrup, medicated with naphthol beta (see page 194), because at this stage there are no spores present. This is employed by the nurse-bees in preparing food for the larvæ, and in this way the bacilli are destroyed. We can further assist the bees by using preventive measures later on.

Apart, however, from experienced bee-keepers or trained experts, very few are fortunate enough to detect the disease at such an early stage, or to effect a cure so easily, and it becomes advisable to describe the method of procedure in ordinary cases—that is, when the combs have irregular patches of brood, with

sunken and perforated cappings to the cells containing the coffee-coloured mass inside, as seen in plate facing page 173. In this condition the cells are crowded with innumerable spores, and the treatment just mentioned would not have the slightest effect upon them.

If the colony be weak, destruction of bees, combs, frames, and quilts, together with thorough disinfection of hives, is by far the best course to pursue. We thus destroy the spores, and so remove the source of infection. If, on the contrary, the colony be still strong in bees, the latter may be preserved by making an artificial swarm of them. They are then confined in a straw skep and fed on syrup medicated with naphthol beta. The frames, combs, and quilts must be burned, and the hive disinfected by being either steamed or scrubbed with boiling water and soap, then painted over with a solution of carbolic acid (one part of Calvert's No. 5 carbolic acid to two parts of water, see page 198). When the smell has disappeared it will be ready for use. The bees are kept confined to the skep for forty-eight hours, by which time all honey they may have taken with them will have been consumed, and such of the bees as are diseased will have died off. Those remaining are then shaken from the skep into a clean frame-hive furnished with six frames, fitted with full sheets of comb-foundation, and are fed with medicated syrup for a few days longer. The skep used as their temporary home must then be burnt. All such work as is here described should be done in the evening, when the bees have ceased flying for the day, to avoid chance of robbing.

The whole secret of success lies in having the drug ever present to act on the micro-organism, and either kill it or prevent its development and growth.

In his endeavours to rid his apiary of foul brood, the bee-keeper must, by keeping the bees strong with

young and prolific queens, good wholesome food, cleanliness, and proper ventilation, also raise to its proper standard the lowered vitality of his bees, which enabled the disease germs to get a footing.

Foul brood is so extremely contagious that it is advisable at all times to adopt preventive measures against infection. Naphthaline in balls is generally used, two of these split in half being the proper dose. The pieces are placed on the floor-board of the hive, in the corners farthest from the entrance. The temperature of the hive causes the naphthaline to evaporate, and it must be therefore renewed as required. All syrup used for feeding should also be medicated with naphthol beta. Clothes, appliances, and hands must be washed with carbolic soap, and other articles disinfected by spraying with a solution of one ounce of Calvert's No. 5 carbolic acid in twelve ounces of water.

It was formerly thought that honey was the only source of infection, so that, if bees were starved until they had got rid of the honey carried by them from the diseased hive, a cure would be effected. We now know that this starvation method, good as far as it goes, has always failed from the fact of its not embracing disinfection of hives and appliances. The spores, which were not destroyed, and whose vitality was only latent, were possibly lurking in hidden places, to be some day brought into contact with suitable nourishing material, when they would again start into growth, and thus the disease constantly broke out.

My experiments with soluble phenyle have shown it to be a powerful disinfectant, possessing all the good properties of carbolic acid, but superior to this, inasmuch as it is entirely non-corrosive and non-poisonous as regards human beings and animals. But it must not be forgotten that in large doses it is destructive

to insects, therefore the proportions which here follow must on no account be exceeded.

Several most successful cures have been effected with it when dealt with as under:—Prepare a clean hive, which has been washed or painted over with solution No. 10 (page 198). Remove brood-combs one at a time from the infected hive, shake the bees into the clean hive, spray the combs with solution No. 8, and place them also into the clean hive. Remove all superfluous combs, spray them as before, and extract the honey. The latter may be boiled, and if wanted as food for bees it should be diluted and phenyle added in the proportions given in No. 7. Close up with division-boards, and commence feeding with syrup, using a quarter of a teaspoonful of phenyle to one quart. If the bees take kindly to this, the proportion may be gradually increased, but must not exceed one teaspoonful to a quart of syrup. If bees refuse the food (which is probable if they have access to other stores), pour the weakest medicated syrup into the combs round the brood. They will soon learn to take it in the usual way. As more combs are required, give them those sprayed with solution No. 8. Then by liberal feeding stimulate brood-raising, and if the disease does not give way replace the queen by a healthy one.

So rapidly has foul brood spread by contagion that in one season, unless precautions are taken, a whole neighbourhood may become affected, and the chances of successful bee-keeping seriously imperilled, if not utterly destroyed.

Black Brood.—This disease has only recently made its appearance in this country, and a casual observer might no doubt mistake it for foul brood, its appearance being similar; but on close inspection the symptoms are sufficiently distinct to be easily recognised.

The brood has perforated cappings, but the characteristic odour and ropiness are absent. A yellowish spot near the head appears when the larvæ are first attacked, and when death occurs they turn yellow, then dark brown, finally becoming black. The tracheæ decompose also, so that the ropiness and odour characteristic of foul brood is entirely absent. The chitine, on the contrary, does not entirely disappear as in foul brood, but in the scale that remains are seen distinct traces of the head, thorax, and abdomen. Black brood first made its appearance in America in 1898. It spread with fearful virulence over the entire eastern portion of the State of New York, and is steadily on the increase, being constantly reported from new locations. In dealing with the disease, the same treatment is recommended as for foul brood. Those who have had experience state that it sometimes disappears of itself, but is most destructive in the early summer. Being extremely infectious, it should on no account be allowed to get a footing in an apiary. Possibly one of the new bacilli found by Dr. Burri, and mentioned on page 174, has some connection with this disease. Those interested are referred to a paper on "Brood Diseases of Bees," read by me at the annual meeting of the British Bee-keepers' Association on March 21, 1907, which appears on page 132 of the *British Bee Journal* for same year.

Sour Brood.—Dr. Burri, in his researches, came across another brood disease, differing from those already described. In this disease the active agent is a bacillus of the form *Güntheri.* Bacilli of this family are found in sour milk, and are the cause of its turning sour. The dead larva lies extended on the cell-wall, and changes to a greyish colour, finally becoming dirty yellow, and there is a strong acid smell, resembling

that of vinegar. The chitine is not decomposed, but remains tough, so that the watery contents are preserved as in a sack. The remains can easily be drawn out of the cell without rupturing the chitine covering, which is sometimes so tough that some effort is required to pierce it. Fig. 125 shows (*a*) groups and (*b*) isolated individuals of *Bacillus Güntheri*. Dr. Burri made the unexpected discovery that this bacillus was

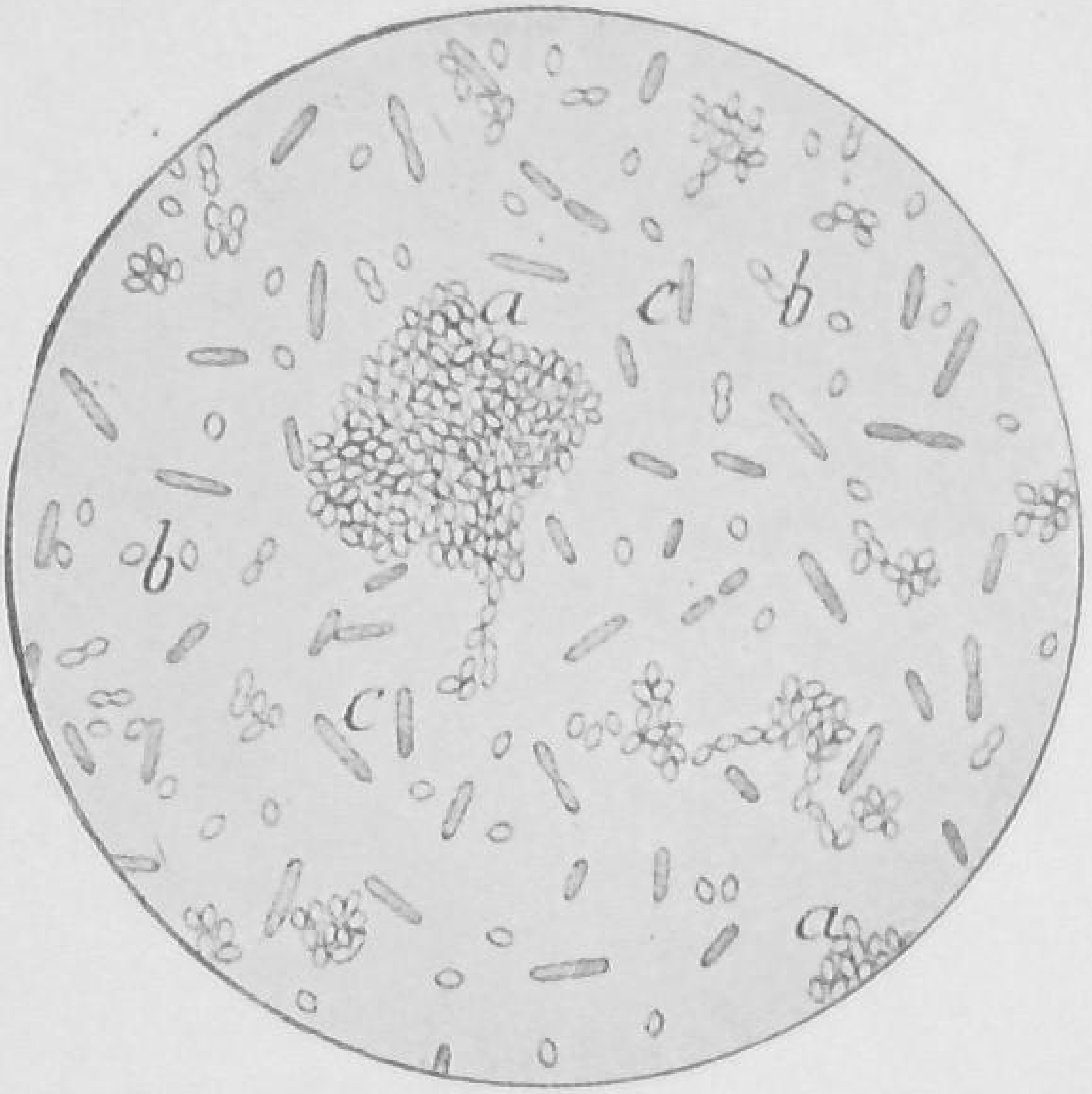


Fig. 125.—*Bacillus Güntheri*.

generally found in company with that of virulent foul brood (*Bacillus alvei*), and in very rare instances did it occur alone. In Fig. 120 a group (*b*) is found amidst *Bacillus alvei*, both being present in the same cell.

The treatment advised for foul brood is recommended when a sour smell is noticed along with the usual characteristics of that disease. If these are absent, it is recommended to replace the old queen by a young and vigorous one.

Chilled Brood.—Strictly speaking, this is not a disease at all, but is often mistaken for foul brood. It arises from various causes, such as hives not being well protected in the spring; this causes the bees to cluster more closely for warmth, thus exposing some of the brood to cold. At other times the queen deposits more eggs during a warm spell in spring than the bees can cover should a cold snap follow, and in either case the whole of the brood thus exposed dies. When this occurs the larvæ turn first grey, and afterwards become nearly black (never brown, as with foul brood). The dead larvæ are also generally removed by the bees, but they seldom attempt to carry out those which have died from disease, except under conditions mentioned on page 178.

Bee Paralysis.—This disease is not new, nor is it very prevalent in this country, but is known in the warmer climate of Southern Europe.

In the early stages bees will be noticed with abdomen much swollen, and of a dull black appearance, running from the entrance and about the alighting-board, and in doing this they frequently fall on to the ground. Later, some are seen trembling or shaking, with wings bent up in an unnatural position. On opening a hive, bees in similar condition will be found running about; but sooner or later they work their way to the entrance, and perish in a few hours, after falling to the ground. The disease is apparently more contagious than infectious, and seems to be communicated rather by dead or sick bees than by brood or combs. It also not seldom disappears as suddenly as it comes.

The treatment recommended by Mr. Root is removal of the queen and substituting another from a healthy hive. Some bee-keepers have also succeeded in effect-

ing a cure by removing the diseased stock to the stand of a healthy one, putting this where the former stood. The healthy bees are said to carry out the paralytic ones, which otherwise would be allowed to crawl about in the affected hive, and as they are removed the stock gradually recovers. In the Southern United States, where the disease is prevalent, flowers of sulphur sprinkled over the affected bees and combs by means of a powder-bellows has been found to effect a cure. But it must be borne in mind that sulphur kills all unsealed brood and destroys the eggs; therefore care should be taken not to allow it to come in contact with either eggs or brood. When using sulphur the brood is removed, and given to a strong, healthy stock. At first the disease appears worse, but soon an improvement is observed, until finally a cure is effected. Mr. Poppleton, who has had considerable experience on the subject, recommends a repetition of the treatment in about ten days, in order to make sure that every bee has been dusted with sulphur. It is also advised to apply the remedy in the evening, when all the bees are at home. Very little that can be relied on is known as to the cause of bee paralysis. Dr. White, of the U.S. Department of Agriculture in Washington, made bacteriological examinations in 1903 of a number of bees affected with the disease, taken from various apiaries in New York State. Several species of bacteria were found, and some experimental cultures made; but no conclusions could be drawn from the results obtained as to the cause of the malady.

The May Pest.—This is, in some respects, similar to paralysis, and resembles the disease epidemic in the Isle of Wight in 1906, and which caused great destruction of bees there, as already mentioned on page 170. On the Continent it is known as *mal de mai,*

or by the Germans as *Maikrankheit,* because of it usually appearing in May and June when an early spell of warm weather is followed by cold and foggy days. In 1853 and 1855, after wet and cold springs, an epidemic of this disease raged in France and neighbouring countries, and about ten years later an attack of such severity occurred in some cantons of Northern France that the number of hives was reduced to one-third, and in some places to a fourth. I have had a few cases of a mild type in my own apiary, but the disease disappeared of itself.

As in paralysis, bees will be seen coming from the hive and running about the alighting-board, from which they drop to the ground, being unable to fly. They crawl about the ground, some ascending blades of grass to gain an eminence from which to take wing, but in every attempt fall to the ground again. They will also be seen towards evening gathering in clusters for warmth, but most of them die during the night from exposure. Any survivors usually succumb next day. The disease attacks indiscriminately bees young or old, and the abdomen of those affected appears slightly inflated, the whole body being covered with a light grey dust. The stomach, when examined, is found to contain a small quantity of light-coloured fluid, and at the end of the large intestine there will be seen a yellow knot of partially-digested pollen.

In the year 1865 Dr. E. Assmuss described the disease, in "Die Parasiten der Honigbiene," as one caused by a well-known micro-organism termed *Mucor mellitophorus.* This was further studied by Drs. Benneman and Hübner, who published the results of their researches in the *Bienenzeitung* of 1881 (page 7). They found spores of what they termed *Mucor mucedo* (Fig. 126) among the fat corpuscles of

the abdomen, and also discovered threads of mycelium encircling the tracheæ (Fig. 126: *a*, spore; *b*, mycelium; *c*, yeast-like cell), in some cases so thickly as to prevent the circulation of air for the distension of the air-sacs. This is the reason why the bees are unable to fly. Spores developing mycelium were also found in abundance in the lower portion of the abdomen, and these, pressing on the large intestine,

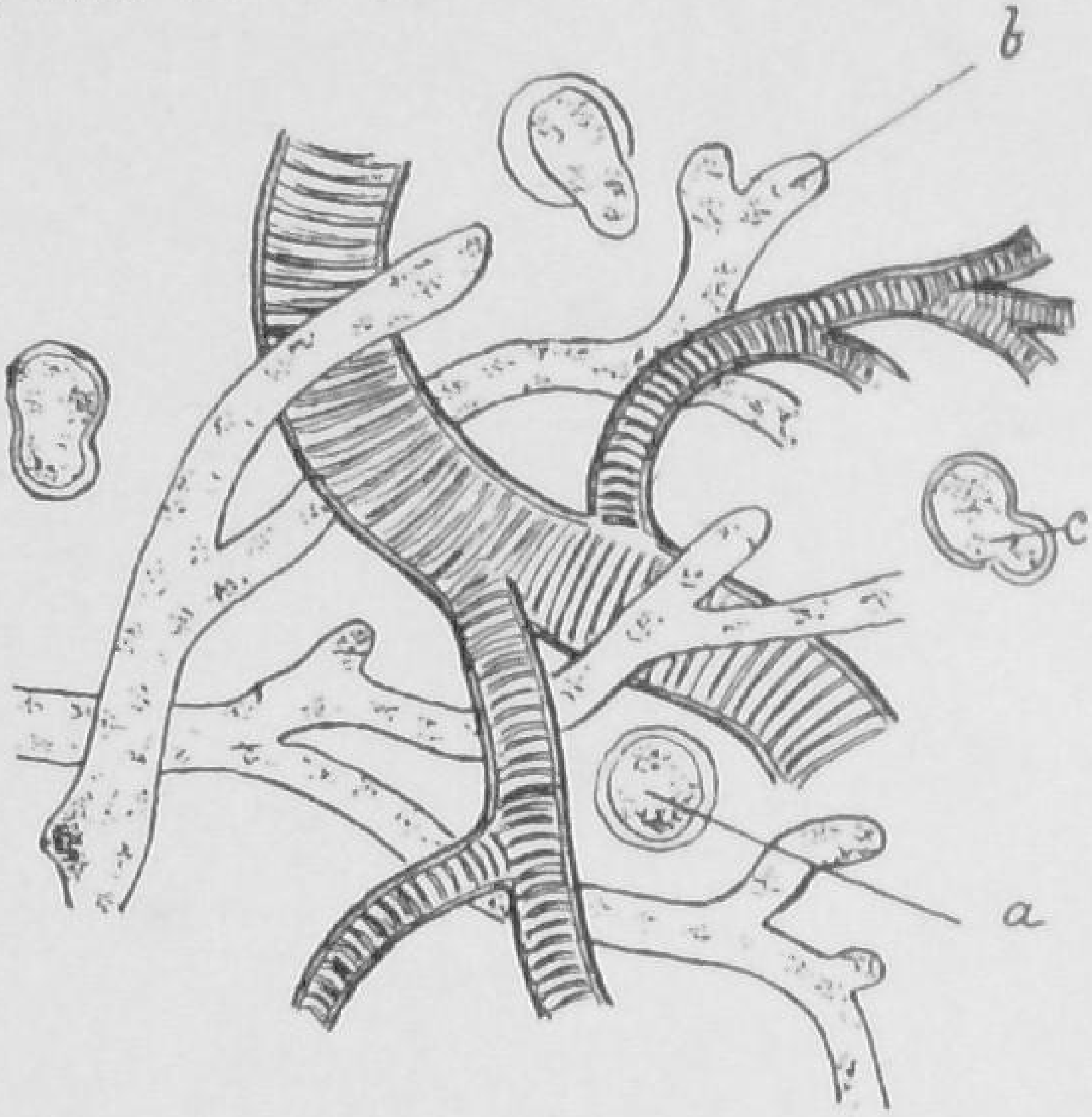


Fig. 126.—*Mucor mucedo* encircling Tracheæ. A, spore; B, mycelium.

obstruct the anal opening, and cause abdominal distension. In some districts of Germany *Mucor mellitophorus* attacks a great number of both young and old bees, and is so abundant in some colonies that it frequently stops up the chyle stomach completely with spores. In this way digestion is impeded, and, according to Drs. Leuckart and Dönhoff, violent dysentery follows.

The disease is attributed to improper food, pollen

An Old Fashioned Apiary in Kent.

damaged by early-morning frosts being mentioned as a contributing cause. Herr F. Gerstung, editor of *Die Deutsche Bienenzucht,* and one of the leading German bee-keepers, attributes the disease to bad food and fermentation caused by it, and says the cause is to be looked for several weeks before an outbreak, when the bees have been fed with syrup instead of honey. Now that so much of the sugar used is made from beet instead of cane, it is not surprising to hear of such outbreaks. No reliable remedy is known, but whatever the disease may prove to be, bee-keepers in England need not feel alarmed, as it does not necessarily follow that it would become epidemic even if it made its appearance here.

XXXVII.—WINTERING.

Bees, like any other stock, if well wintered, are ready in spring for a good summer's labour, but otherwise will take the best part of the season to gain sufficient strength to even sustain themselves. Success thus depends in a great measure on the proper preparation of a colony for wintering. The requirements are:—1st. An abundance of sealed stores. 2nd. A large number of young bees and a prolific queen. 3rd. Provision for sufficient and proper ventilation without cold draught.

By the middle of September ascertain the exact condition of every colony, and if breeding has been kept up by stimulative feeding, this should now be discontinued, and the bees fed up as rapidly as possible to ensure sealing of all stores before the approach of cold

weather, and thus avoid the risk of dysentery induced by wintering bees on unsealed stores. Hives should contain about 30 lbs. of food (see page 112), and those with a superabundance of stores may spare a frame or two for colonies short of food.

All combs not covered by bees on both sides should be removed, and the size of the hive reduced by division-boards placed on either side, so as to crowd the bees into as small a space as possible. There should be sufficient bees to crowd eight frames, and these should be placed $1\frac{3}{4}$ inches from centre to centre for the winter months, using alternately a wide (2-inch) and a narrow ($1\frac{3}{4}$-inch) metal end. The middle combs are generally used for breeding, while honey is stored in the side combs; and as bees cluster near the centre, these latter, if filled half-way down, should be inserted in the middle, so that the bees may be near their stores. They also require empty combs to cluster upon, therefore those full of stores should be placed on each side of cluster.

Winter-passages may be provided by placing a couple of pieces of wood, $\frac{5}{8}$ths of an inch square, across the top of the frames, and about $\frac{5}{8}$ths of an inch apart. Or by placing a good-sized cake of candy below the quilts, bees will make their own passages over frames. Over all place the quilts or a chaff-cushion. A bottomless box, size of the hive-top, and 4 inches deep, having a piece of calico tacked on the bottom, and filled with chaff, or a shallow-frame super, as shown in Fig. 23, makes a very good cover, allowing sufficient ventilation without draught.

The space between the hive and outer casing should be filled with chaff or other material, such as drugget, carpet, or paper torn into small pieces; this will prevent the escape of heat, and greatly assist in keeping an even temperature within the hive. When there is

no longer any danger of robbing, the entrance should be opened to 6 inches, and the bees disturbed as little as possible. All these preparations for wintering should be completed by the beginning of October. If in the autumn we have not been able to feed up our bees, and have no frames of sealed stores to give them, candy will supply them with the necessary food for safe wintering.

Entrances should be shaded from direct rays of the sun when ground is covered with snow, bright sunlight often tempting bees out in winter, only to perish. The claustral chamber described on page 50 will be found useful at such times in saving the lives of bees and preventing spring dwindling.

About the end of February, if the weather permit, an examination of hives may be made by gently lifting the quilt and looking between the combs, and if any are short of stores a cake of soft candy (see Recipe No. 2) may be placed on frames under the calico cover, care being taken that it is put immediately over the cluster of bees. The bee-keeper must bear in mind that a large number of bees will consume less food proportionally than a smaller number, and that the heat produced in the hive by the bees is in proportion to their numbers and the food consumed. During winter entrances should be examined frequently, and any dead bees found there removed with a hooked wire, as an accumulation of dead bodies might smother those in the hive. Such an accident, however, is likely to happen only if zig-zag entrances are used, or the opening left for entrance be too narrow.

As success in wintering depends upon having strong colonies, containing a large number of young bees, all weak ones must be united, so that at least six or eight combs are well crowded with bees.

Messrs. Herrod & Stewart's Apiary, Luton, Bedfordshire.

XXXVIII.—CLEANING HIVES.

All hives, floor-boards, and frames that have been in use should be scalded and thoroughly cleansed before they are used again. Winter is a convenient time for doing this, so that they may be ready for work again in the spring. In addition, they should be painted over with solution No. 10 (page 198), mentioned in next chapter as a preventive of foul brood. Empty combs should be fumigated with burning sulphur, and sprayed with No. 8 or No. 9, before being used again. These solutions are inexpensive, and the prudent bee-keeper will be well repaid for the simple precautions he may take to prevent the introduction of foul brood into his apiary. In any case, precaution is better than cure.

XXXIX.—RECIPES.

No. 1. Naphthol Beta Solution.—Naphthol beta was introduced after exhaustive experiments by Dr. Lortet, and subsequent experience here has proved its efficacy. To make the solution proceed as follows: For convenience of measuring, procure from a chemist an 8-oz. bottle, marked with sixteen divisions of half an ounce (Fig. 127). Thus each division will be equal to one tablespoonful. Put an ounce of naphthol beta into the bottle, and half-fill with pure methylated spirit. Shake until the crystals are dissolved. Then add spirit till the liquid reaches the fourteenth line on the bottle. The solution is then ready for use. Each division will contain one tablespoonful, which is just the right quantity for 10 lbs. of

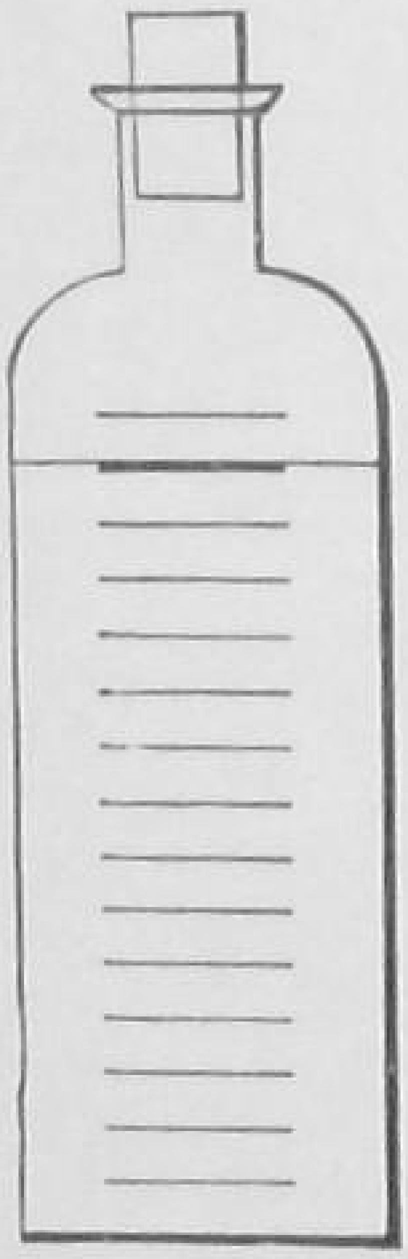


Fig. 127.

sugar. The solution should be stirred into the syrup while the latter is still hot.

No. 2. Soft Bee-candy.—The most reliable recipe for general use in making bee-candy is that known as Br. Colomban's formula. Being a skilled confectioner, the directions given are based on sound lines, such as a sugar-boiler would follow, and, if carefully and *strictly* adhered to, the result will be a candy smooth in grain (like the fondant sugars used by confectioners) that will remain soft and "buttery" for several months after making.

Use an ordinary enamelled pan, or preserving pan, and into this put 10 lbs. of cane-sugar (white crystals) and two quarts of water (hot for preference). Place over a clear, bright fire, and stir until the sugar is quite dissolved. When it begins to boil draw the pan aside for a moment, and while it continues to boil slowly remove the scum and other impurities from the surface of the sugar. This done, return the pan to the fire, and *let it boil as fast as possible,* without stirring, for about twenty minutes. Then, to ascertain if boiled enough, have a bowl of cold water ready at hand, and dip the forefinger of one hand first in the cold water, then quickly into the boiling sugar, then again in cold water; now, with the sugar adhering to the forefinger, try to make a soft ball from it, like a piece of mastic ready for use. These last operations should only *occupy two or three seconds.* The forefinger must be kept curved whilst dipping it into the boiling sugar, and though a little smartness and courage are required to do it for the first time, it is not difficult and does not burn the finger at all. A sugar-boiling thermometer would be a convenient substitute for a beginner.

If unable to make a ball in the way mentioned, the

sugar must be boiled a little longer, otherwise the boiling is finished.

Remove the pan from the fire, and in cooling the mixture pour it into a tin about 12 by 10 inches. In one of this size the candy will cool sufficiently in an hour, or in far less time if the vessel is placed in cold water. During the cooling process *do not stir while hot*. Note this well, for without this precaution the candy will be not smooth, but rough, in grain.

When the sugar has so cooled down that the finger may be kept in it for half a minute without scalding, then begin to stir, and continue to do so until the candy becomes white and stiff. It is now finished, but in order to transfer it into suitable moulds it must be warmed again; therefore, the whole is put into another pan or vessel which fits on to a boiler containing hot water. In a short time the candy becomes more or less liquid, like cream, and an occasional stir must be given to dissolve all lumps. When properly dissolved and brought to almost boiling-point (say, 204 deg. Fahr.), pour it into the moulds or boxes and allow it to cool. Candy thus made, if stored in a dry, cool room, will keep soft for a very long time.

If the sugar has been accidentally overboiled (in which case it is brittle, and breaks when tested), add a little water and boil again to the proper point. As a preventive of overboiling, remove the pan from the fire while testing whether cooked enough. Also, to prevent mishap in another direction, *i.e.*, boiling over, the pan used for making the candy should not be more than half-full.

No. 3. "Scholtz Candy" or "Good's Candy."—Mix together warm liquid honey and finely-powdered loaf-sugar until the consistency of stiff putty is reached. Allow this to stand, and work in a little

fresh sugar on several following days until all the honey is absorbed.

No. 4. Medicated Candy.—This is made like No 2, but when the syrup is taken off the fire stir in one table-spoonful of naphthol beta solution No. 1 to every 10 lbs. of sugar used.

No. 5. Spring and Summer Food for Bees.

White lump cane sugar	10 lbs.
Water	7 pints.
Vinegar	1 oz.
Naphthol beta solution, No. 1	½ oz.
Salt	1 oz.

Boil for a few minutes.

No. 6. Autumn Food for Bees.

White lump cane sugar	10 lbs.
Water	5 pints.
Vinegar	1 oz.
Naphthol beta solution, No. 1	½ oz.
Salt	½ oz.

Boil for a few minutes.

No. 7. Syrup for Feeding.

Soluble phenyle	¼ to 1 teaspoonful.
Sugar syrup	1 quart.

The sugar syrup can be made as in Recipes Nos. 5 and 6, omitting the naphthol beta solution No. 1.

Note.—The water and syrup *must always be poured on the phenyle,* and it will then, on shaking, form an emulsion.

No. 8. Soluble Phenyle Solution for Spraying and Disinfecting.

Soluble phenyle	½ teaspoonful.
Water	1 quart.

No. 9. Soluble Phenyle Solution for Washing Hives, Floor-boards, &c.

Soluble phenyle	2 teaspoonfuls.
Water	1 quart.

Note.—Soluble phenyle is quite different from *phenol* (carbolic acid), see page 181. If there is any difficulty in obtaining it at a chemist's, apply to the manufacturers, Morris, Little, & Co., Doncaster.

No. 10. Carbolic Solution for Painting Hives, and Carbolised Cloth for Quieting Bees.

Calvert's No. 5 carbolic acid ...	1 part.
Water	2 parts.

No. 11. Carbolic Solution for Disinfecting Clothing, Hands, &c.

Calvert's No. 5 carbolic acid ...	1 oz.
Water	12 ozs.

XL.—GENERAL MANAGEMENT.

Spring.—If the weather be favourable about the end of March, every hive in the apiary should be thoroughly inspected to ascertain its exact condition. Examine each comb as it is removed and make certain of the presence of a queen. If she has commenced to lay, the bees may be further stimulated by uncapping some of the honey. Reduce the size of the hive by division-boards to the strength of the colony, and in all cases where the frames have been spaced wider apart than the ordinary distance for the winter (see page 191), change the ends so that the frames are 1½ inches from centre to centre—this being the ordinary distance for brood-raising—and place the superfluous combs in the space outside division-boards. If a colony is found to be queenless, unite it to one having a fertile queen. This

should also be done if the queen chances to be a drone-breeder; in such a case she should be removed. Any colonies short of provisions should be fed or assisted

Fig. 128.—Manipulating in Bee-dress and Veil.

with frames of sealed stores taken from those hives which can spare them. Keep all hives well covered and protected from the cold; contract entrances to exclude robbers.

Stimulate breeding by uncapping honey-cells, and supply artificial pollen as long as the bees will take it, also water, and directly any stocks are found getting short of stores commence gentle feeding with liquid food.

It takes about six weeks to build up a colony of sufficient strength to take advantage of an early flow of honey.

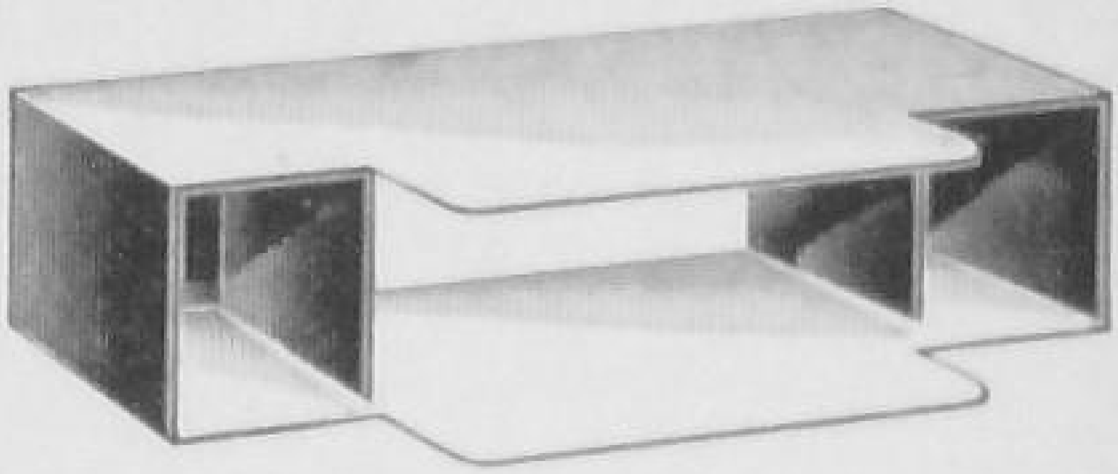


Fig. 129.—"W.B.C." Metal End (for spacing frames).

Prepare for queen-rearing early in April by introducing drone-comb into the centre of those hives intended to be used for rearing drones, and when drones begin hatching out remove the queen from the colony intended for raising queens.

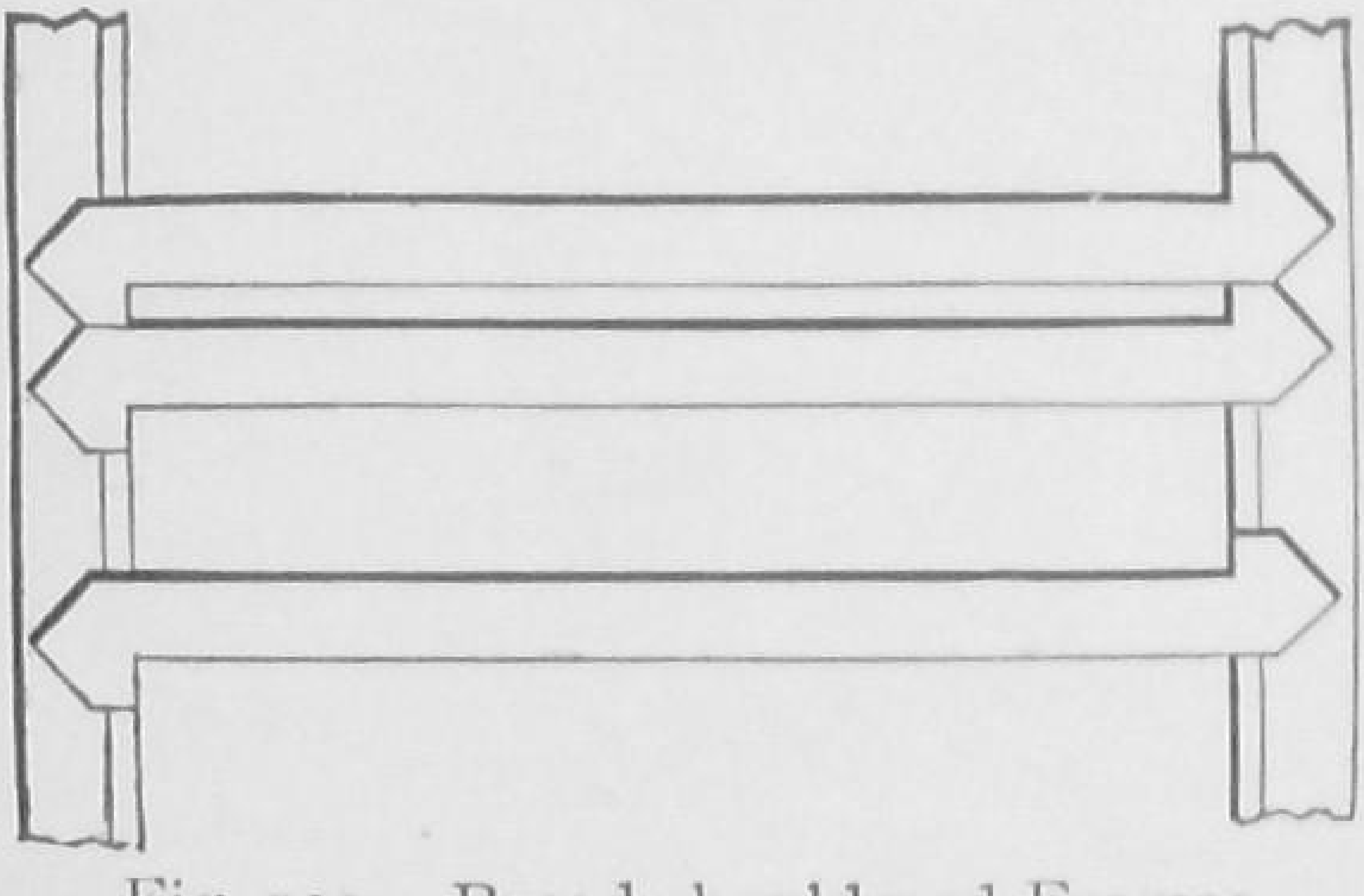


Fig. 130.—Broad-shouldered Frames.

Form nuclei as soon as queen-cells are ready for introduction to them.

Supply food as often as may be required.

In the beginning of May, if the weather be favourable, the winter chaff-packing may be removed, and the frames and bees transferred to clean hives, giving them also clean floor-boards. The best plan is to move the stock on one side, putting a clean hive in its place, and transfer the frames and bees into this. The other hive can then be cleansed, have a coat of paint, and

will be ready for the next stock. Where drones are not required place the frames 1¼ inches from centre to centre by means of the "W.B.C." end (Fig. 129). Be on the look-out for foul brood, and if present commence treatment with one or other of the remedies recommended without delay.

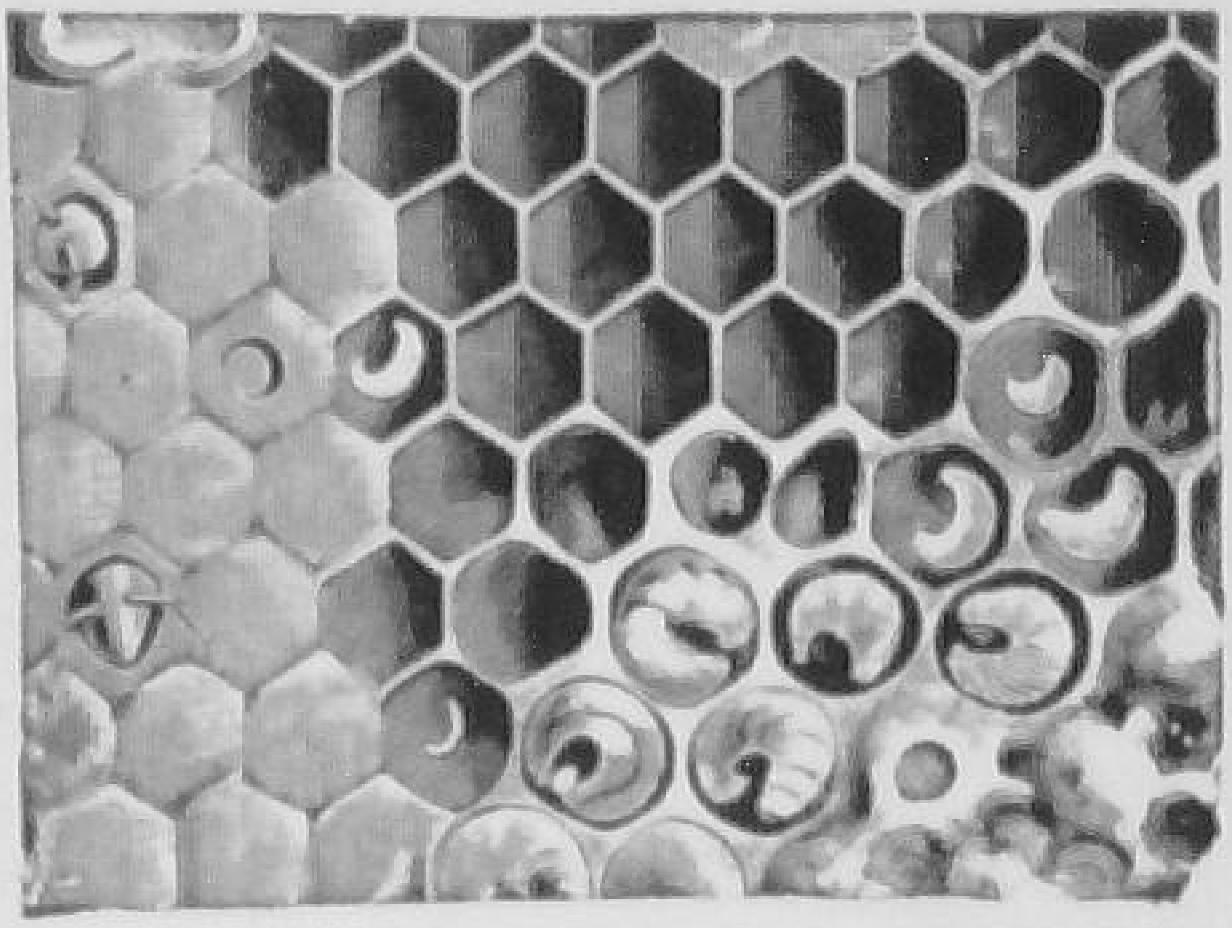


Fig. 131.—Hatchin Brood in all Stages from Egg to Insect.

As brood-nest becomes enlarged and bees need more room, push division-board to one side and insert at side one of the superfluous combs previously removed when contracting brood-nest. In this way add combs gradually till the full number is introduced.

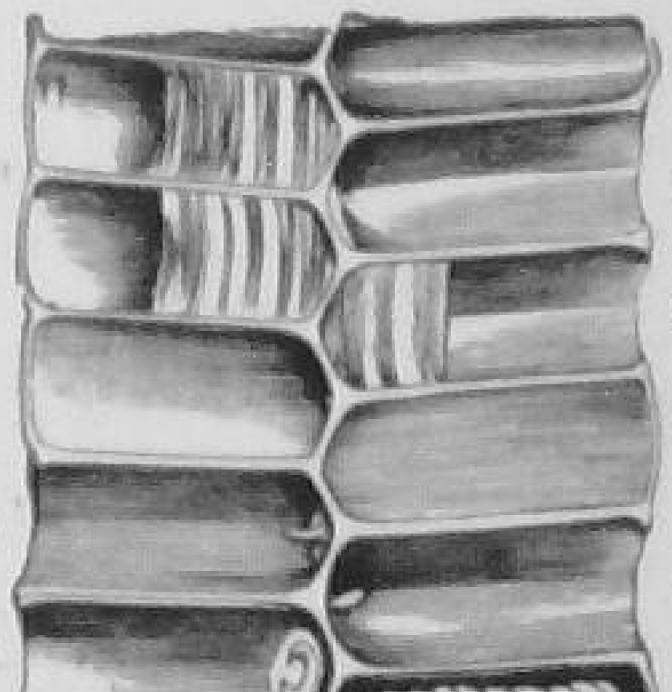


Fig. 132.—Section of Brood Comb: *a*, sealed pollen; *b*, eggs; *c*, larvæ; *d*, sealed honey; *e*, pollen; *f*, empty cell.

SUMMER.—When bees begin to collect honey in large quantity, place a rack of sections on the hive, and proceed as recommended on page 58. To prevent swarming give additional room in advance of the bees' requirements.

Double those colonies intended for extracting, and extract at suitable intervals. Open entrances to full width. Make artificial swarms if required, and check swarming by removing frames of brood, cutting out queen-cells and extracting honey.

Learn how to recognise brood in all stages, from the egg to perfect insect. (See Figs. 131 and 132.)

AUTUMN.—When honey becomes scarce outside, remove unfinished sections and shallow-combs (Fig. 38), extract the honey, and return them to the bees to clean before being stored away. Prepare for winter by stimulative feeding; unite weak colonies, and re-queen those found queenless. Prepare honey for market and for showing, if need be, at various shows held about this time.

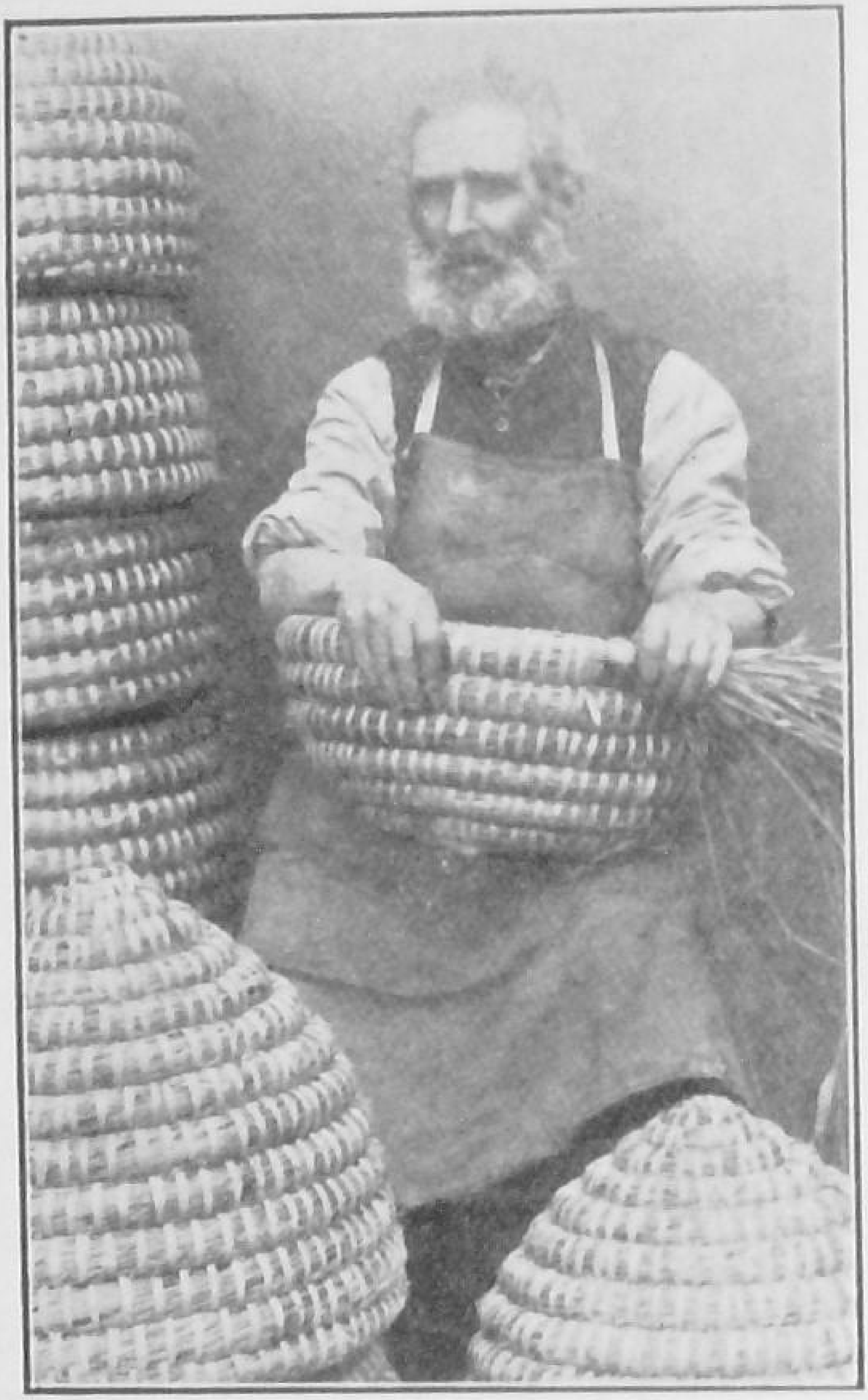


Fig. 133.—Willie Gordon, Skep-maker.
Died July, 1906, aged 82 years.

Those who desire to make their bee-keeping profitable should attend a honey show occasionally in order to see how their produce can be made attractive for market, and where (as stated on page 4) they may receive a useful lesson by witnessing demonstrations of practical bee-work in the lecture tent shown on next page.

The British Bee-keepers' Association Bee-tent at the "Royal" Show (1907).

The management of bees on modern lines has so completely revolutionised bee-craft of late years that it is difficult to realise the fact that so lately as July, 1906, there died in Aberdeenshire an old-time worthy who for forty-five years plied his trade of straw skep making in the old thatched cottage shown in photo below, and regularly carted his skeps to market in

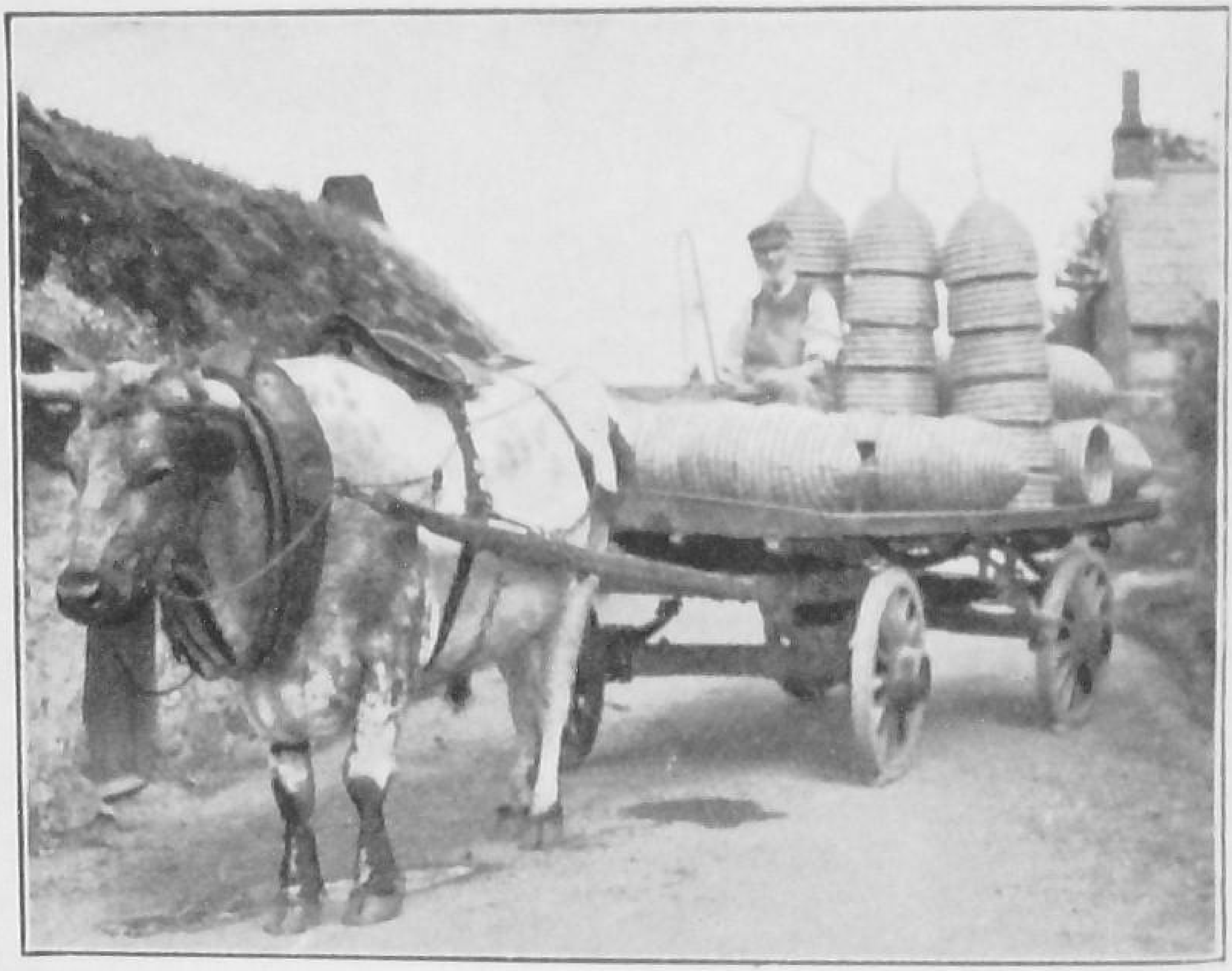


Fig. 134.—Willie Gordon Taking his Skeps to Market.

the ox-wagon seen. Willie Gordon (Fig. 133), who had been a soldier in the Scots Guards till invalided home, was a well-known worthy character, and, being a widower, lived alone in his cottage, and maintained himself in comfort by his adopted trade, dying at the ripe age of eighty-two years. He was hard to convince that the modern frame-hive could ever form so healthy a home for bees as his own stout skeps, and

maybe he was right. Anyway, his portrait and his work form an interesting reminiscence of the past.

When examining frames in autumn, combs contain-

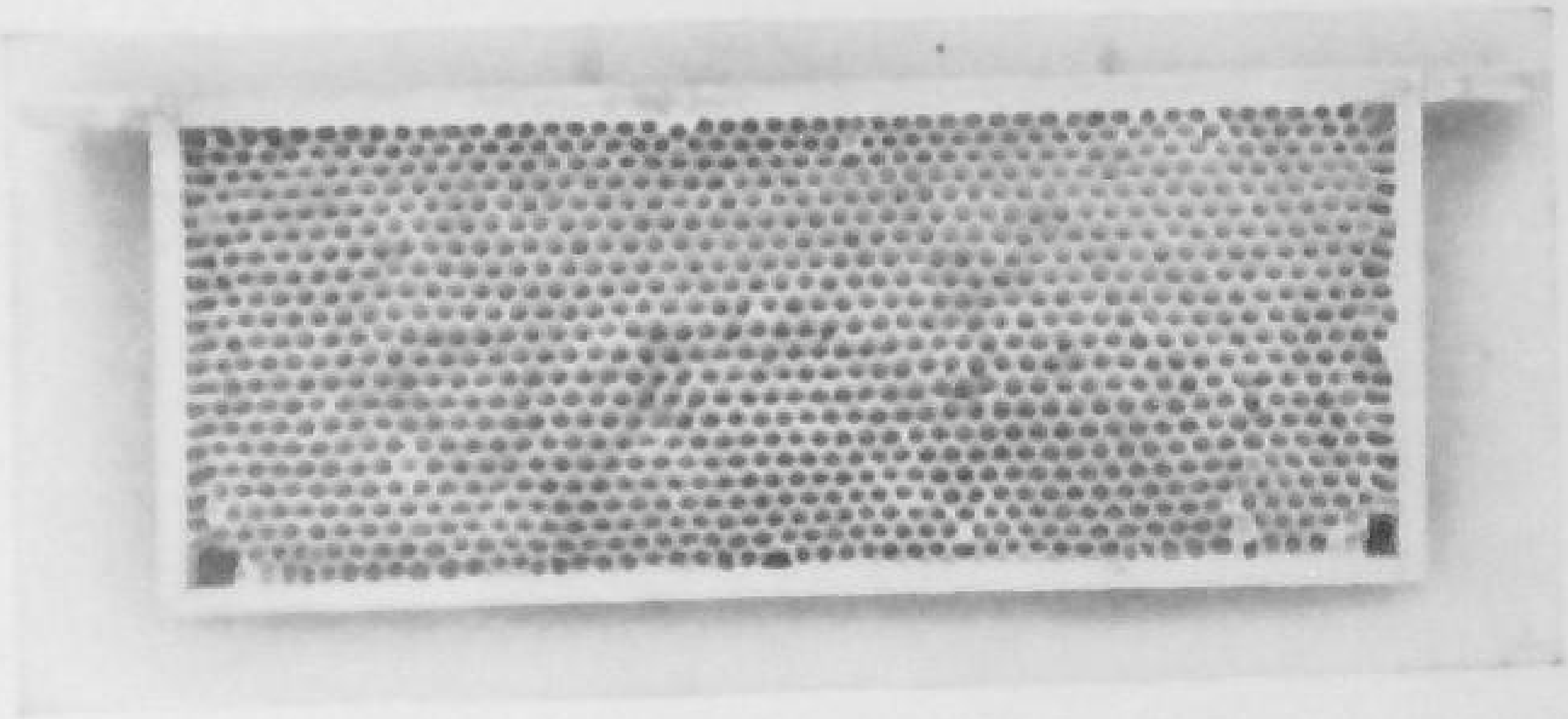


Fig. 135.—Combed Shallow-frame after Extracting.

ing many drone cells should be removed, superfluous drones being a nuisance for many reasons. They also

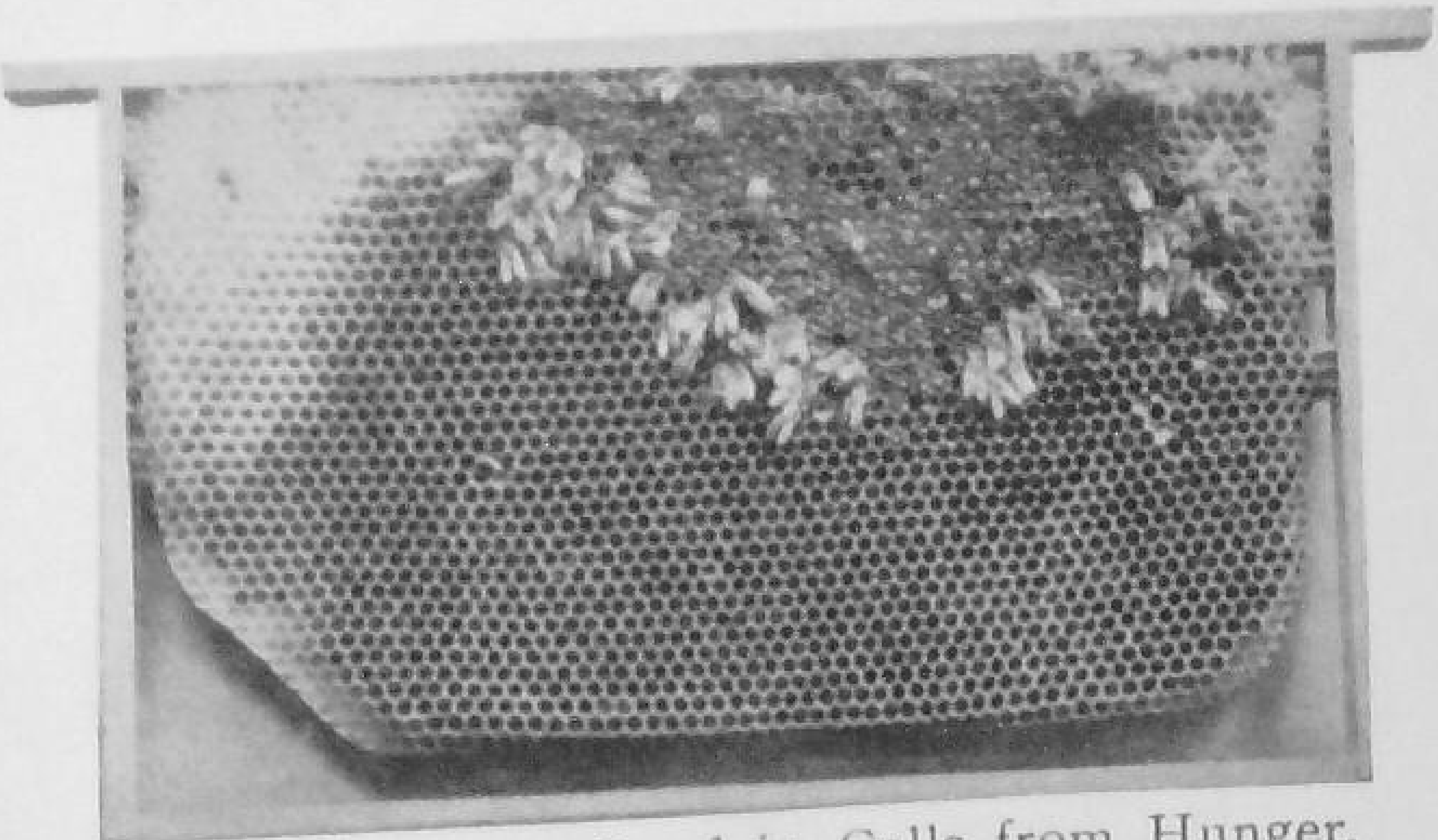


Fig. 136.—Bees Dead in Cells from Hunger.

cause the gruesome sight seen in the photo (from life) on next page, showing the flight-board, hive-

front, and ground below covered with dead and dying outcast drones.

In the middle of September commence to feed up rapidly, and extract all unsealed stores. Reduce the number of frames to the strength of the colonies, place the frames $1\frac{3}{4}$ inches from centre to centre, contract

Fig. 137.—Slaughtered Drones (a Single Day's Work).

the space by division-boards, cut winter passages, or make passages over the combs by placing sticks under the quilts. Pack with chaff, reduce the size of entrances, and complete all arrangements for wintering by the beginning of October. After there is no longer danger from robbers open the entrance to 6 inches.

WINTER.—If the directions given in the chapter on "Wintering" (page 190) have been properly carried out, the bees will be provided for and their welfare ensured. But in following the advice given in preceding pages, the bee-keeper should not work by "rule of thumb"; he must exercise his intelligence in applying the instructions afforded, and inform himself by thinking out what is best to be done in all the varying circumstances connected with bee-life, in order to achieve success. Hives should be disturbed as little as possible, and the bees left severely alone during the dead season. It is sometimes found that stocks supposed to have an ample supply of stores on hand to last till April are absolutely foodless in February. Miscalculations of this kind cause not a few disasters to strong colonies—such as is mentioned on page 109—in the early spring of every year. Fig. 136 shows a comb taken from a hive in April in which the dead bees are seen head-foremost in the cells, an unmistakable sign of death from starvation.

Other points are also worth consideration by those who regard bee-keeping as a source of income, and with this in view intend to study the scientific side of the craft along with practical work among the bees. During the last few years the bee-industry has been brought so prominently before the public through the columns of the daily press, that young people of both sexes in considerable numbers are seeking to qualify themselves as experts of the British Bee-keepers' Association (see "Introduction," page 1). The examinations connected therewith are now conducted on very different lines from those in vogue twenty years ago, and students trained at the various colleges established for the furtherance of technical instruction are doing valuable work both at home and abroad in connection with the craft.

B.B.K.A. Exams. for Expert's Certificate. Girl Student "Driving" Bees

The photo on opposite page shows a girl student at the Swanley College "driving" bees without veil or gloves, and doing it as well as any bee-man could.

Not less useful is it to study the best methods of manipulating hives with as little disturbance as possible to the bees. In the illustration on page 210 the hive is seen open, and a centre-frame being examined, but the combs on both sides are kept covered by the quilts so that disturbance of bees and exposure of brood to cold is reduced to a minimum, while the free flight of the bees is uninterrupted.

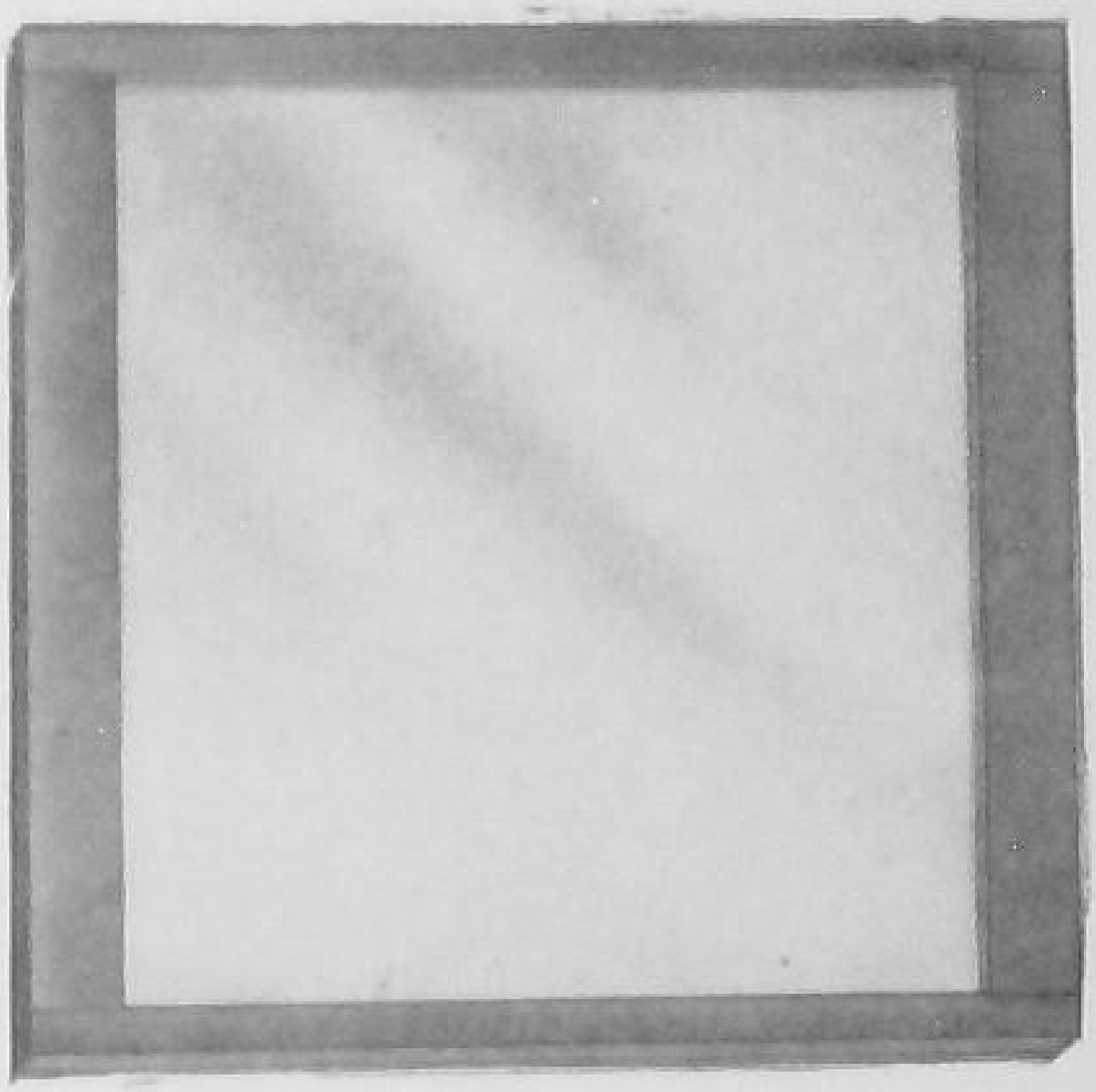


Fig. 138.—Winter Covers. Burgess's Glass Quilt.

Opinions differ on the question of protecting bees in winter, my own views thereon being given in previous pages; some bee-keepers, however, dispense entirely with warm coverings, and use the so-called glass quilt. Fig. 138 shows a good quilt of this type, made by Messrs. Burgess and Son, Exeter. It allows free passage-way above the top-bars, and bees are said to winter well with no other covering at all.

The contrast between the conditions under which bee-keeping is seen and understood to-day and that of former times may be judged from the illustration, Fig. 139, from a recent photograph, wherein is seen an ancient bee-house (unfortunately not now occupied by its skeps) near Maxstoke, Warwickshire. Located

Examining Frame-hives without Unduly Disturbing Bees or Uncovering the Frames.

close to the road, it is in full view of passers-by, which probably accounts for the strong iron bars showing the original staples for padlocks, no doubt intended to protect the skeps from honey-thieves existing in ancient times as to-day.

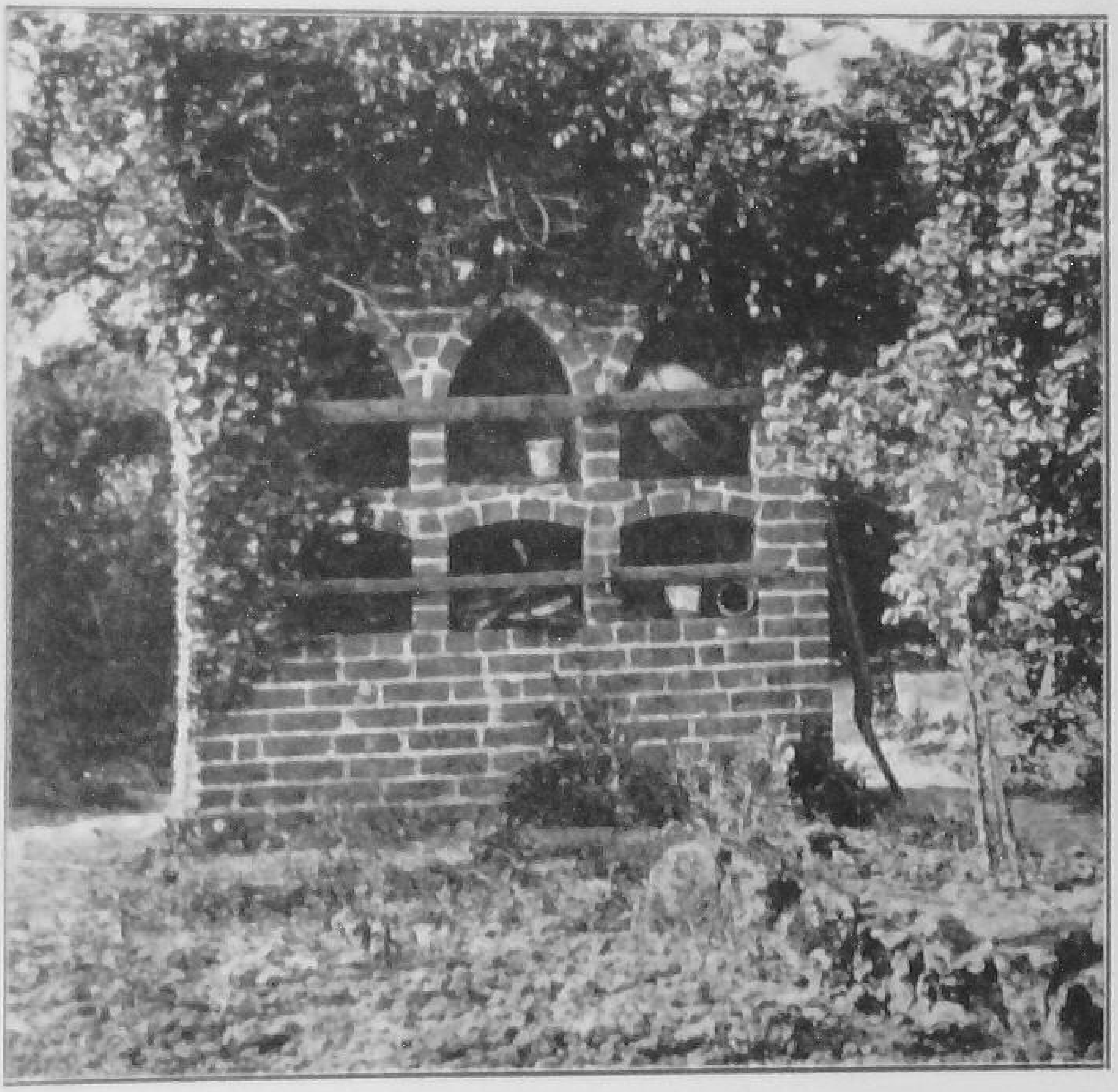


Fig. 139.—Ancient Bee-house in Warwickshire.

A good observatory hive, Fig. 140 (if available), is in the highest sense useful when studying the scientific side of bee life. The double-glazed sides of this hive are of plate glass, consequently there is no distortion of bees or other objects under observation when examined through a magnifying-glass. A pair of stout

brass discs (E), lathe turned, ensure accuracy and smoothness in working without any friction when the

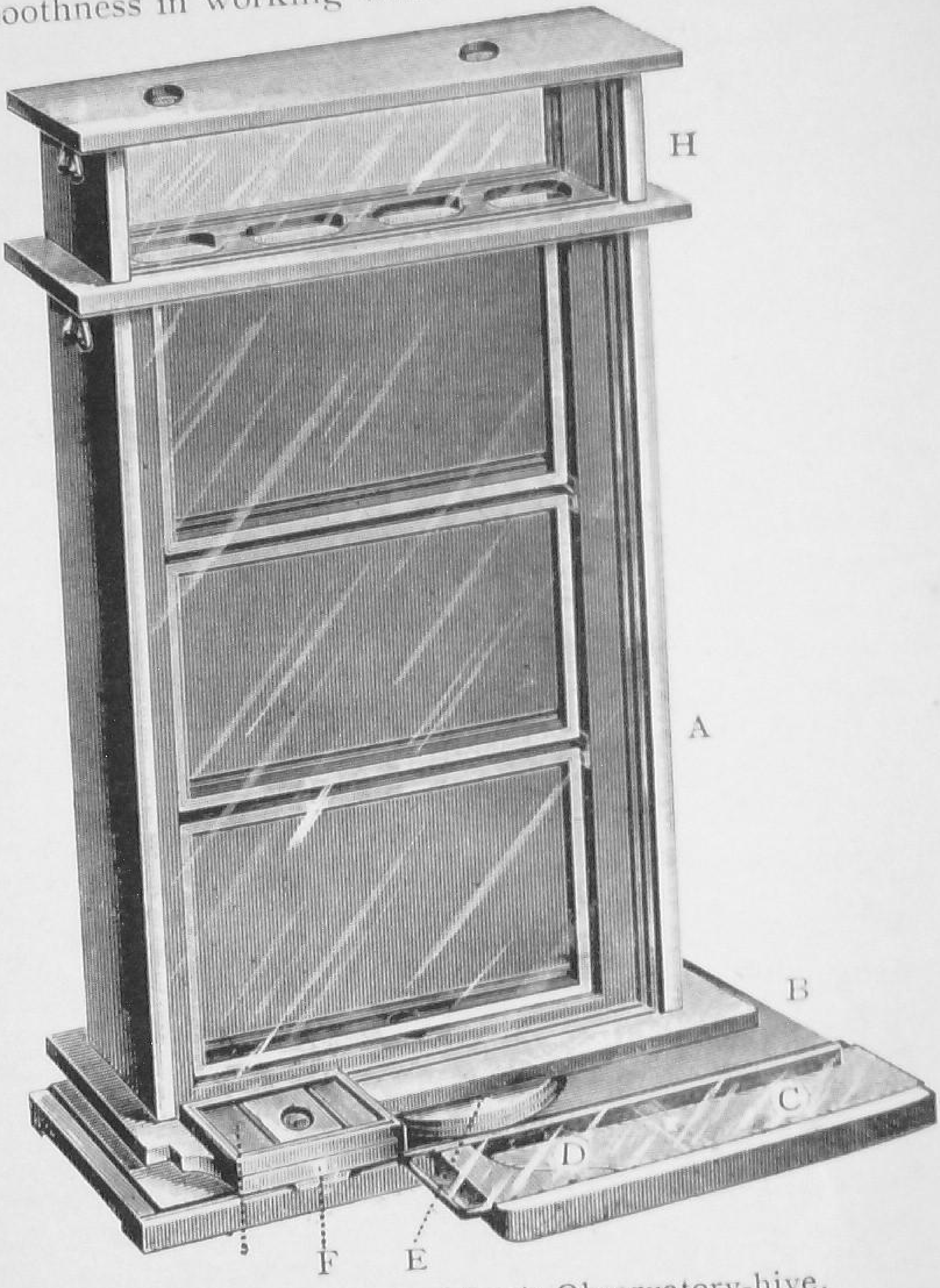


Fig. 140.—Lee and Son's Observatory-hive.

hive is made to revolve on the base (B). The glass-covered tunnel (C), being long, gives full opportunity

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exposing combs and rough handling of the bees at this season will cause queens to be "balled" and killed by the bees themselves, as already mentioned on page 122. Queens are also liable to take flight and be lost if the bees are excited by the operator through untimely manipulations in the early spring-time. But stores are the most important point at this

Fig. 141.—Bee-glove with Bared Fingers.

season, and if food is short, a cake of soft candy (see recipe No. 2) must be given at once, or the whole colony may perish (see Fig. 136, page 205).

Those who value time in the management of an apiary should keep a note-book and make accurate entries of all operations and observations, to simplify which "The British Bee-keeper's Practical Note-book" has been arranged, and may be had from the *Bee Journal* office.

Carefully read and study all the directions given in the foregoing chapters. No instructions have been given but those which the writer has himself thoroughly tested, and he has endeavoured to put these into such plain language that any person of intelligence may succeed and become proficient in the management of bees in movable-comb hives with both comfort and profit.

In the event of difficulties arising, questions are replied to through the weekly *British Bee Journal*, or the monthly *Bee-keepers' Record*, on writing to the office, 8, Henrietta Street, Covent Garden, London.

The usefulness of the "Queries and Replies" column in these journals is manifested by the frequent letters received from readers (beginners especially),

Fig 142.—Shading Swarm from Hot Sunshine.

who save the trouble of writing by referring to replies in back numbers applicable to their case. In this way also a line or two on "what to do and how to do

The British Bee-keepers' Association's Exhibit, "Royal" Show, Lincoln, 1907.
(View of frontage only.)

it " may easily save a mishap, such as losing a swarm on a hot day for want of shade from the hot sun. The photo on page 215 (from nature) will serve to illustrate our point as showing a swarm so protected and ventilated that it could be safely left till evening or next day before being hived.

Among the ever-varying conditions under which bee-work is necessarily carried out, it is impossible to include concise directions applicable to every case. Therefore, those who imagine that, whenever a difficulty arises, they have merely to consult the index of their " Guide Book " in order to find an easy way out of it will sometimes be disappointed. It may, however, be said that the present index is sufficiently comprehensive for anyone, being more copious than any of its predecessors, and as complete as is possible. But the adage " Bees do nothing invariably " is a truism to be borne in mind by all who keep bees, and the difference between a good and a bad bee-keeper may be safely gauged by the manner in which such intelligence as he is blessed with is exercised in the performance of all operations connected with his work among the bees.

Mention is made in the introduction (page 4) of the annual shows held by the British Bee-keepers' Association, in connection with those of the Royal Agricultural Society of England, in various counties throughout the country. These exhibitions of bee-produce, along with the extensive displays of hives and bee-appliances of every kind pertaining to them, should be seen by everyone who is in any way interested in bee culture. The practical demonstration given in the bee-tent, showing how easily live bees can be handled by the skilled bee-keeper on these occasions, afford an object lesson of great value to those who are desirous of taking up the craft either for business or pleasure.

Indeed, it may be safely said that it would save much disappointment, time, and money to many if advantage is taken of a chance visit to the "Royal" show being held in the district, or, failing that, to any good county B.K.A. show, wherever held, before making a start with bees.

In the photo of bee-tent (page 203) is seen the B.B.K.A. lecturer, Mr. W. Herrod, and the audience gathered round him, at the "Royal" show, held at Lincoln in June, 1907. The exhibits—a portion of which are seen in the background—are more plainly shown on page 216, and give a more reliable idea of the show in question than any word-picture could possibly afford of this part of the parent Society's work, while it may with some appropriateness bring to a fitting conclusion the present edition of "The British Bee-keeper's Guide Book."

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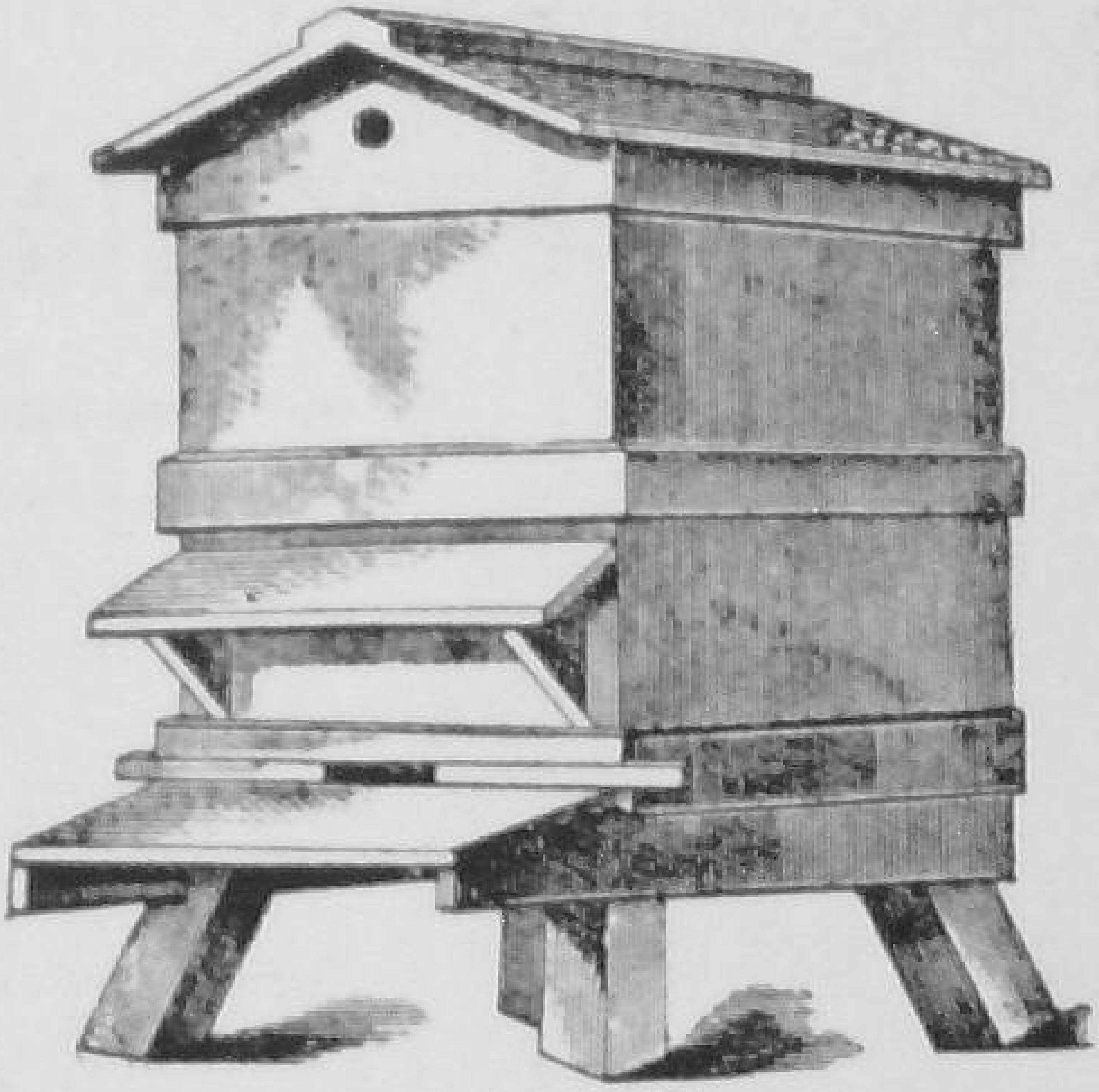

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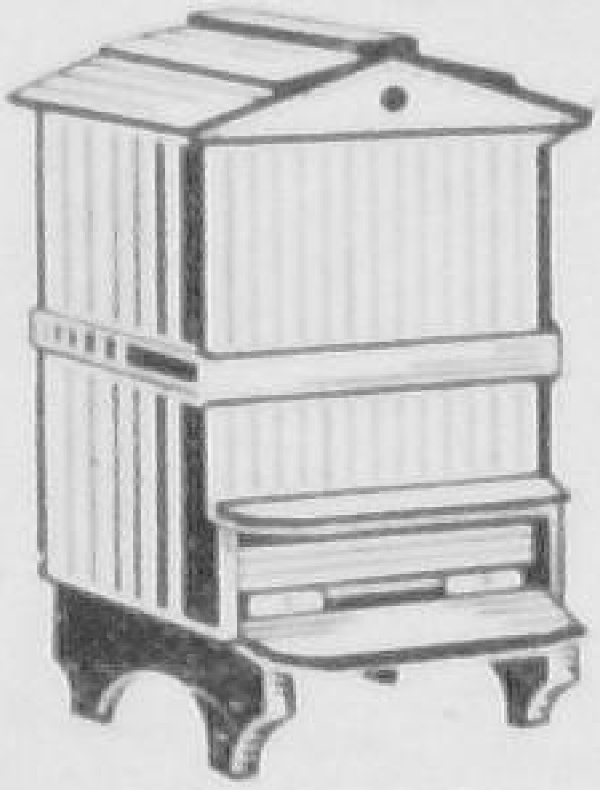

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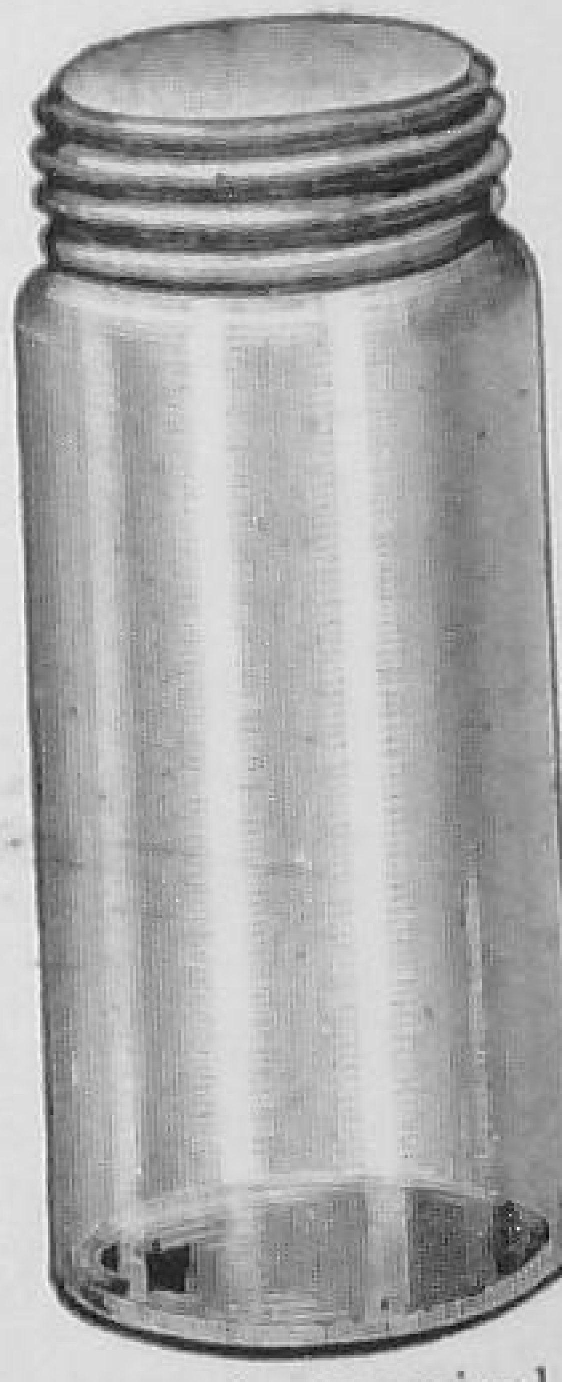

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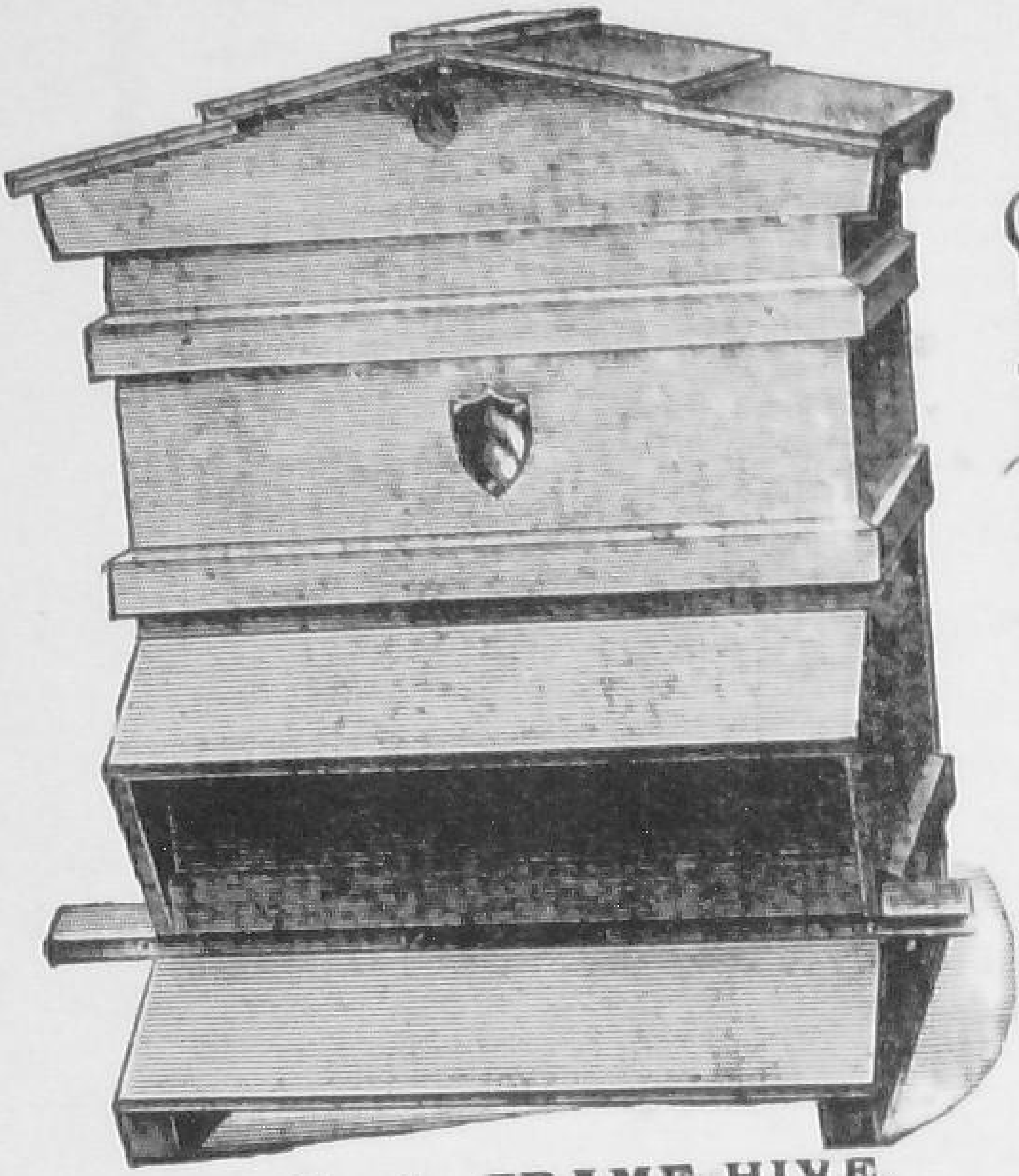

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